RANGE SAFETY GROUP

DOCUMENT 306-93

RSG-306-93

FLIGHT TERMINATION RECEIVER CATALOG

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February 1993

Flight Termination Receiver Catalog

Range Safety Group
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White Sands Missile Range, NM 88002-5110

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This catalog provides reference information on ultra-high frequency flight termination receivers used at various U.S. missile ranges and test facilities. It is not intended to be a comprehensive review of all available flight termination receivers. Inclusion in this catalog does not constitute approval or endorsement for use at any government installation. Information in this catalog has been extracted from manufacturers' specifications.

flight termination, receivers

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DOCUMENT 306-93

FLIGHT TERMINATION RECEIVER CATALOG

FEBRUARY 1993

Prepared by

FLIGHT TERMINATION SYSTEM SUBCOMMITTEE
RANGE SAFETY GROUP

Published by

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U.S. Army White Sands Missile Range,
New Mexico 88002-5110

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FOREWORD

This catalog provides reference information on ultrahigh-frequency flight termination receivers used at various U. S. missile ranges and test facilities. It is not intended to be a comprehensive review of all available flight termination receivers, and inclusion of hardware in this catalog does not constitute approval or endorsement for use at any government installation. Use of a specific receiver at a missile range or test facility requires the approval of the commander of that installation. Approval for use of a particular receiver on a given missile at one installation does not constitute automatic approval for use of the same receiver on other missiles at the same installation or on the same missile at other installations.

The information in this catalog has been extracted from manufacturers' specifications. It is provided as reference material only and is not intended as an endorsement of any model.

1. A. R. F. PRODUCTS, INCORPORATED
2559 75th Street
Boulder, Colorado 80301-4699
(Phone: 303-443-4844)

FLIGHT TERMINATION RECEIVERS/DECODERS

Model AR-9B

Model AR-10

Model AR-17

Model AR-34

A. R. F. PRODUCTS, INCORPORATED

COMMAND DESTRUCT RECEIVER

MODEL AR-9B

1. GENERAL DESCRIPTION

The receiver is a solid-state design consisting of the following general sections:

Receiver Section

RF Low-pass Filter
RF Preselector
RF Amplifier
First Mixer (passive)
First IF (60 MHz)
Second Mixer (Active)
Second IF (10.7 MHz)
Crystal Filter
Limiting Amplifier
Quadrature Detector
Video Buffer Amplifier

Decoder Section

Four Channel Decoders (PPL)
Relay Drivers
Four Output Relays (Dry contact)

Power

24 to 34 Vdc
Latching Relay Control (for remote operation)

Telemetry Outputs

Input RF Level Monitor
Battery Voltage

2. BACKGROUND

The Model AR-9B has been used on the following programs: Pershing, Aerobee, Black Brant, PQM-102, GBU-15, Standard Arm, Aries/Aries Chaser, QF-85, QF-100, QF-102, QF-106 and MGGB.

3. TECHNICAL SPECIFICATIONS

3.1	Frequency Range (Tuneable)	400 to 550 MHz
3.2	Frequency Deviation	30 kHz per channel (nominal)
3.2	Threshold Sensitivity	-110 dBm
3.3	Operating Bandwidth	180 kHz minimum at -3 dB 600 kHz maximum at -60 dB
3.4	Maximum Useable RF Input	1 Vrms
3.5	Input RF Impedance	50 ohms
3.6	VSWR	2.0:1 maximum
3.7	Local Oscillator Stability	±0.003 percent
3.8	Tuning Accuracy	0.005 percent
3.9	Tuning Increments	Continuous
3.10	RFI Suppression	MIL-STD-461; CS08 Limit A - 50 dBm, Limit B - 0 dBm, CS01, CE01, CE02, CE03, CE04, CE06
3.11	AM Rejection	No interference at 90 percent modulation
3.12	Noise Immunity	Very high (uses PLL decoders)
3.13	Buffered Video Output	0.5 Vrms (approximately)
3.14	Decoded Output Channels	4
3.15	Usable Tones	4 (simultaneous)
3.16	Tone Channel Bandwidth	±3 percent < BW > ±5 percent
3.17	Adjacent Channel Rejection	PLL decoders will not respond to adjacent channels
3.18	Output (relay) Current	2.0 Amps (make or break)

3.19	Output Isolation	>1.0 Mohm
3.20	Command Response Time	<25 milliseconds
3.21	Command Change Delay	<25 milliseconds
3.22	Power Requirements	
	Standby	<130 milliamps (RCVR Active)
	Command Activation	<30 milliamps increase for each channel activated
3.23	Temperature Range	
	Operating	-40 to +71°C
	Non-operating	-60 to +85°C
3.24	Humidity	0 to 95 percent relative
3.25	Altitude	No limit
3.26	Shock	100 g-peak, 11 ms, halfsine 150 g-peak, 1 ms, halfsine
3.27	Acceleration	100 g, any axis (centrifuge)
3.28	Vibration	20 g-peak, swept sine, 20-2,000 Hz
3.29	Volume	59 cubic inches
3.30	Dimensions	5.20 X 4.312 X2.625 inches
3.31	Weight	3.75 pounds maximum
3.32	Mounting Attitude	Non-restricted
3.33	External Adjustments	None
3.34	External Connections	See Outline Drawing
3.35	Mounting Dimensions	3.875 X 4.750 inches

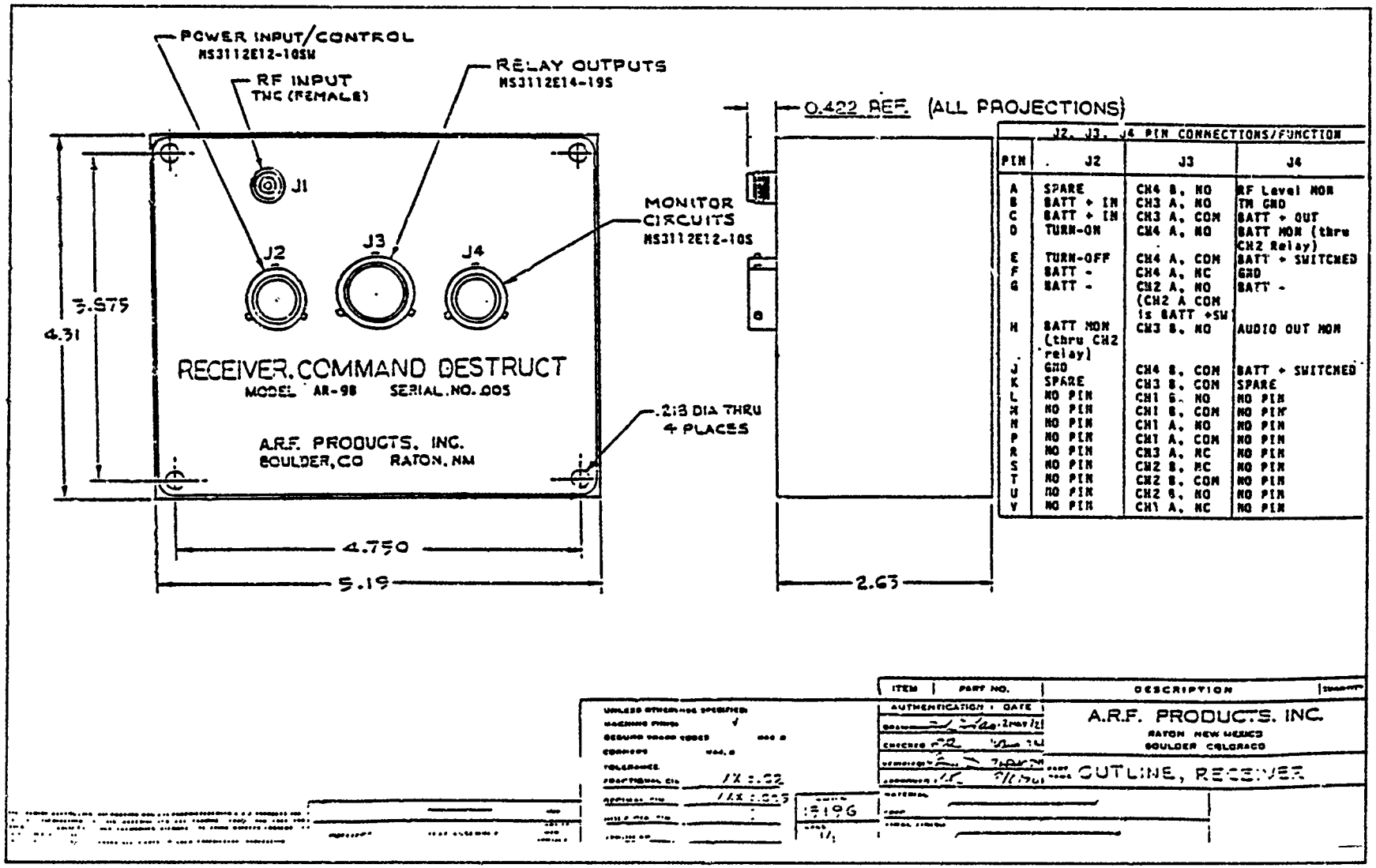


Figure 1-1. A.R.F. Model AR-9B Range Safety Receiver.

A. R. F. PRODUCTS, INCORPORATED

COMMAND DESTRUCT RECEIVER

MODEL AR-10

1. GENERAL DESCRIPTION

The A.R.F. Model AR-10 Command Destruct Receiver is basically the same design as the Model AR-9B. The receiver consists of the following general sections:

Receiver Section

RF Low-pass Filter
RF Preselector
RF Amplifier
First Mixer (passive)
First IF (60 MHz)
Second Mixer (Active)
Second IF (10.7 MHz)
Crystal Filter
Limiting Amplifier
Quadrature Detector
Video Buffer Amplifier

Decoder Section

Four Channel Decoders (PPL)
Relay Drivers
Four Output Relays (Dry contact)

Power

24 to 34 Vdc
Latching Relay Control (for remote operation)

Telemetry Outputs

Input RF Level Monitor
Battery Voltage

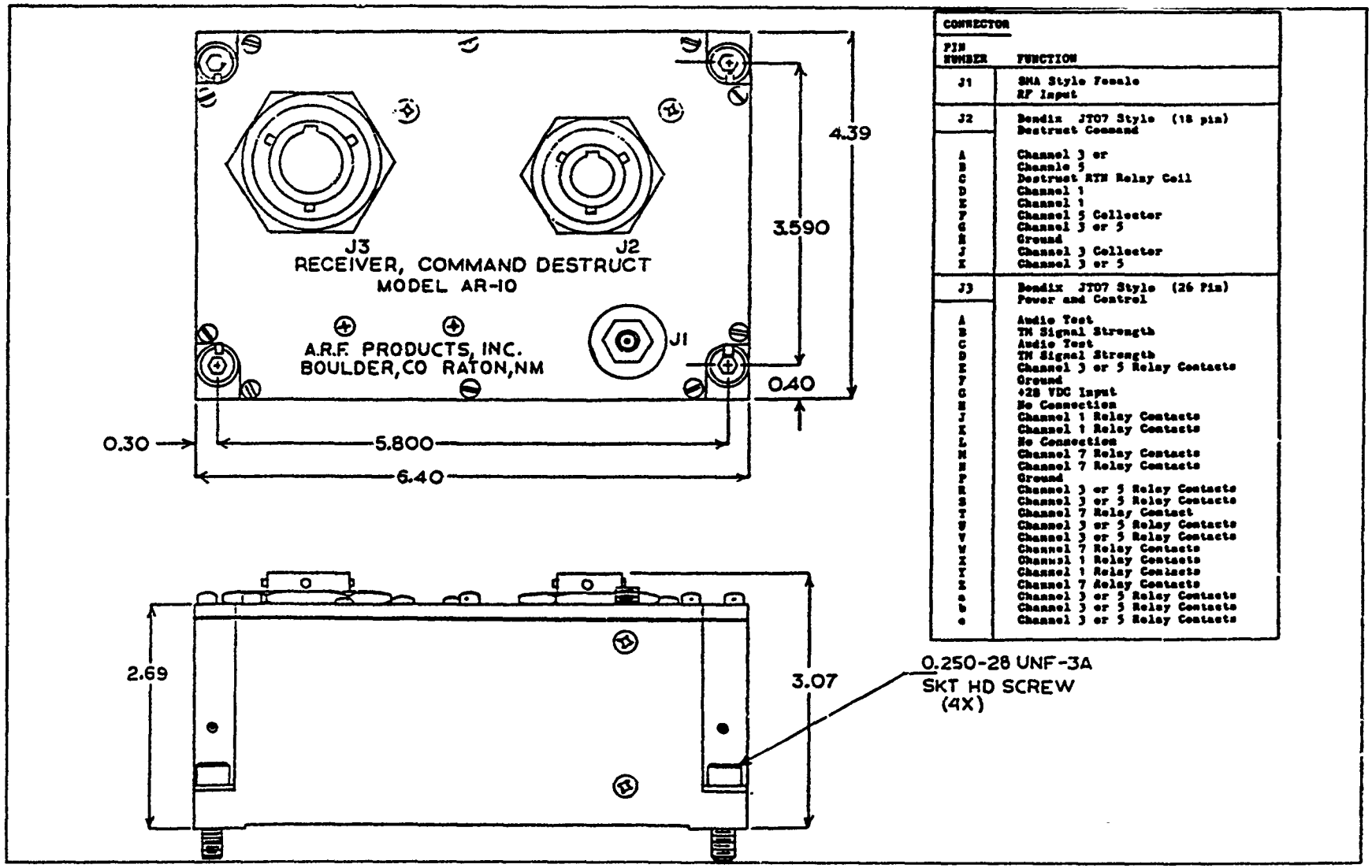
2. BACKGROUND

The Model AR-10 has been used on the SRAM program.

3. TECHNICAL SPECIFICATIONS

3.1	Frequency Range (Tuneable)	400 to 550 MHz
3.2	Frequency Deviation	30 kHz per channel (nominal)
3.2	Threshold Sensitivity	-110 dBm
3.3	Operating Bandwidth	180 kHz minimum at -3 dB 600 kHz maximum at -60 dB
3.4	Maximum Useable RF Input	1 Vrms
3.5	Input RF Impedance	50 ohms
3.6	VSWR	2.0:1 maximum
3.7	Local Oscillator Stability	±0.003 percent
3.8	Tuning Accuracy	0.005 percent
3.9	Tuning Increments	Continuous
3.10	RFI Suppression	MIL-STD-461; CS08 Limit A - 50 dBm, Limit B - 0 dBm, CS01, CE01, CE02, CE03, CE04, CE06
3.11	AM Rejection	No interference at 90 percent modulation
3.12	Noise Immunity	Very high (uses PLL decoders)
3.13	Buffered Video Output	0.5 Vrms (approximately)
3.14	Decoded Output Channels	4
3.15	Usable Tones	4 (simultaneous)
3.16	Tone Channel Bandwidth	±3 percent < BW > ±5 percent
3.17	Adjacent Channel Rejection	PLL decoders will not respond to adjacent channels
3.18	Output (relay) Current	2.0 Amps (make or break)
3.19	Output Isolation	>1.0 Mohm

3.20	Command Response Time	<25 milliseconds
3.21	Command Change Delay	<25 milliseconds
3.22	Power Requirements	
	Standby	<130 milliamps (RCVR Active)
	Command Activation	<30 milliamps increase for each channel activated
3.23	Temperature Range	
	Operating	-40 to +71°C
	Non-operating	-60 to +85°C
3.24	Humidity	0 to 95 percent relative
3.25	Altitude	No limit
3.26	Shock	100 g-peak, 11 ms, halfsine 150 g-peak, 1 ms, halfsine
3.27	Acceleration	100 g, any axis (centrifuge)
3.28	Vibration	20 g-peak, swept sine, 20-2,000 Hz
3.29	Volume	59 cubic inches
3.30	Dimensions	6.10 X 3.99 (maximum) inches
3.31	Weight	3.75 pounds maximum
3.32	Mounting Attitude	Non-restricted
3.33	External Adjustments	None
3.34	External Connections	See Outline Drawing
3.35	Mounting Dimensions	3.590 X 5.800 inches (mounting screws captive)
3.36	Internal Construction	All components selected from the PPL (basically JAN thru JANTXV)



CONNECTOR PIN NUMBER	FUNCTION
J1	SMA Style Female RF Input
J2	Bendix JT07 Style (18 pin) Destruct Command
A	Channel 3 or
B	Channle 5
C	Destruct RTN Relay Coil
D	Channel 1
E	Channel 1
F	Channel 5 Collector
G	Channel 3 or 5
H	Ground
J	Channel 3 Collector
K	Channel 3 or 5
J3	Bendix JT07 Style (26 Pin) Power and Control
A	Audio Test
B	TM Signal Strength
C	Audio Test
D	TM Signal Strength
E	Channel 3 or 5 Relay Contacts
F	Ground
G	+28 VDC Input
H	No Connection
J	Channel 1 Relay Contacts
K	Channel 1 Relay Contacts
L	No Connection
M	Channel 7 Relay Contacts
N	Channel 7 Relay Contacts
P	Ground
R	Channel 3 or 5 Relay Contacts
S	Channel 3 or 5 Relay Contacts
T	Channel 7 Relay Contact
U	Channel 3 or 5 Relay Contacts
V	Channel 3 or 5 Relay Contacts
W	Channel 7 Relay Contacts
X	Channel 1 Relay Contacts
Y	Channel 1 Relay Contacts
Z	Channel 7 Relay Contacts
a	Channel 3 or 5 Relay Contacts
b	Channel 3 or 5 Relay Contacts
c	Channel 3 or 5 Relay Contacts

Figure 1-2. A.R.F. Model AR-10 Range Safety Receiver.

A. R. F. PRODUCTS, INCORPORATED

COMMAND DESTRUCT RECEIVER

MODEL AR-17

1. GENERAL DESCRIPTION

Receiver Section

RF Preselector
RF Amplifier
First Mixer (active)
First IF (60 MHz)
Second Mixer (Active)
Second IF (10.7 MHz)
Crystal Filter (10.7 MHz)
Limiting Amplifier
Quadrature Detector
Video Buffer Amplifier

Decoder Section

Four Channel Decoders (PPL)
Solid-State Outputs (2 channel)

Power

18 to 35 Vdc
Latching Relay Control

Telemetry Outputs

Input RF Level Monitor
Battery Voltage
Individual Channel Activation Monitor

2. BACKGROUND

The Model AR-17 has been used on the Pershing II and ALCM programs.

3. TECHNICAL SPECIFICATIONS

3.1	Frequency Range (Tuneable)	400 to 550 MHz
3.2	Frequency Deviation	30 kHz per channel (nominal)
3.3	Threshold Sensitivity	-110 dBm
3.4	Operating Bandwidth	180 kHz minimum at -3 dB 600 kHz maximum at -60 dB
3.5	Maximum Useable RF Input	1 Vrms
3.6	Input RF Impedance	50 ohms
3.7	VSWR	2.0:1 maximum
3.8	Local Oscillator Stability	±0.003 percent
3.9	Tuning Accuracy	±0.005 percent
3.10	Tuning Increments	Continuous
3.11	RFI Suppression	MIL-STD-461; CS08 Limit A - 50 dBm, Limit B - 0 dBm, CS01, CE01, CE02, CE03, CE04, CE06
3.12	AM Rejection	No interference at 90 percent modulation
3.13	Noise Immunity	Very high (uses PLL decoders)
3.14	Buffered Video Output	0.5 Vrms (approximately)
3.15	Decoded Output Channels	4
3.16	Useable Tones	4 (simultaneously)
3.17	Tone Channel Bandwidth	±3 percent < BW > ±5 percent
3.18	Adjacent Channel Rejection	PLL decoders will not respond to adjacent channels
3.19	Output Type	Solid-state

3.20	Output Current Capability	10 A pulse 2 A continuous
3.21	Output Leakage	500 µA maximum
3.22	Output Isolation	Common ground
3.23	Command Response Time	<25 milliseconds
3.24	Command Change Delay	<25 milliseconds
3.25	Power Requirements	
	Standby	≤60 milliamps (RCVR active)
	Command Activation	30 to 50 milliamps per channel
3.26	Temperature	
	Operating	-40 to +71°C
	Non-operating	-60 to +85°C
3.27	Humidity	0 to 95 percent relative
3.28	Altitude	Unlimited
3.29	Shock	100 g-peak, 11 ms, halfsine 150 g-peak, 1 ms, halfsine
3.30	Vibration	20 g-peak, swept sine, 20-2,000 Hz
3.31	Acceleration	100 g, any axis (centrifuge)
3.32	Volume	49 cubic inches
3.33	Dimensions	5.200 X 4.312 X 2.000 inches
3.34	Weight	2.25 pounds maximum
3.35	Mounting Attitude	Non-restricted
3.36	External Adjustments	None

3.37	External Connections	See Outline Drawing
3.38	Mounting Dimensions	3.875 X 4.750 inches

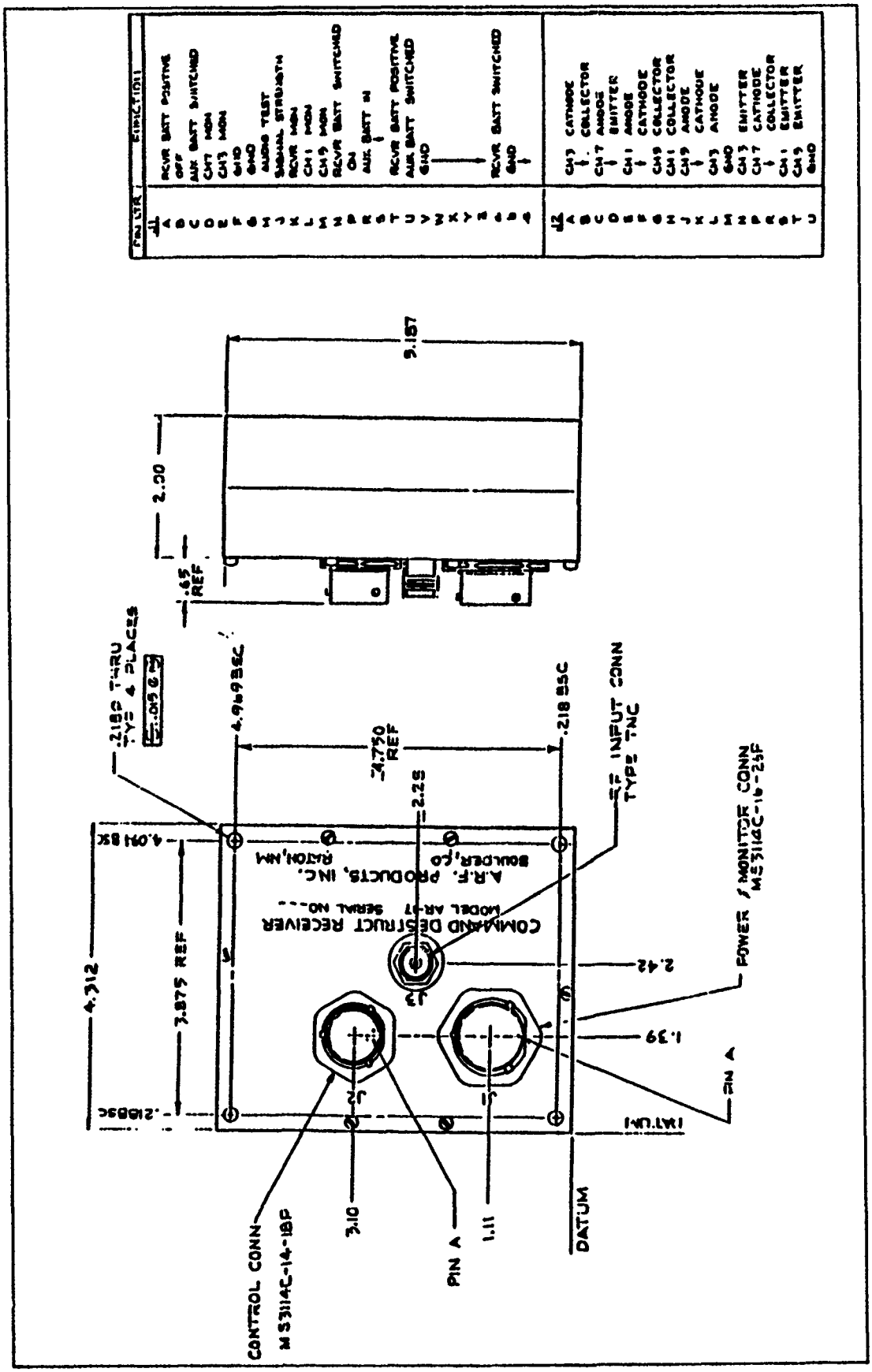


Figure 1-3. A.R.F. Model AR-17 Range Safety Receiver.

A. R. F. PRODUCTS, INCORPORATED

COMMAND DESTRUCT RECEIVER

MODEL AR-34

1. GENERAL DESCRIPTION

The A. R. F. Model AR-34 Command Destruct Receiver is a solid-state design utilizing surface mount technology to reduce the weight and increase the reliabilty of the basic design.

Receiver Section

RF Bandpass Filter
RF Amplifier
First Mixer (Passive)
Second Mixer (Active)
Second IF Amplifier (10.7 MHz)
Crystal Filter (10.7 MHz)
Limiting Amplifier
Quadrature Detector
Video Buffer Amplifier

Decoder Section

PLL Tone Decoders (3)
Command Decode Circuit
Relay Drivers (4)
Output Relays (4)

Power

24 to 36 Vdc Input
Switching Power Regulator

Telemetry Outputs

Input RF Level Monitor

2. BACKGROUND

The receiver is designed to meet the requirements of NWC 1638.

3. TECHNICAL SPECIFICATIONS

3.1	Frequency Range (Tuneable)	406 to 550 MHz
3.2	Frequency Deviation	30 kHz per channel (nominal)
3.3	Threshold Sensitivity	-110 dBm maximum
3.4	Operating Bandwidth	180 kHz minimum at -3 dB 360 kHz maximum at -60 dB
3.5	Maximum Useable RF Input	-20 dBm minimum
3.6	RF Input Impedance	50 ohms
3.7	VSWR	1.5:1 maximum
3.8	Local Oscillator Tolerance	±0.005 percent
3.9	Tuning Increments	Continuous
3.10	Image and Spurious Rejection	60 dB minimum
3.11	RF Signal Strength Output	0.5 to 5.0 Vdc
3.12	Dynamic Stability	Unconditional
3.13	Usable Input Channels	3
3.14	Decoded Output Channels	4
3.15	Usable Tones	3 (simultaneously)
3.16	Output (relay) Current	2.0 A (make or break)
3.17	Output Isolation	>1.0 Mohm
3.18	Command Response Time	<25 ms
3.19	Command Change Delay	<25 ms
3.20	Power Requirements	
	Standby	<180 mA (RCVR active)
	Command Activation	<300 mA (maximum active commands)

3.21	Reverse Polarity Protection	40 Vdc reverse input (no damage)
3.22	Temperature Range	
	Operating	-50 to +85°C
	Non-operating	-50 to +85°C
3.23	Humidity	0 to 95 percent relative
3.24	Altitude	Unlimited
3.25	Shock	50 g-peak terminal sawtooth, 11 ms 30 g-peak trapezoidal, 10 ms
3.26	Vibration	8.9 g rms, random, 20 - 2,000 Hz, 0.04 g^2/Hz
3.27	Dimensions	3.000 x 4.390 x 1.500-in
3.28	Weight	23 ounces maximum
3.29	Mounting Attitude	Non-restricted
3.30	External Adjustments	None
3.31	External Connections	See Outline Drawing
3.32	Mounting Dimensions	2.740 X 3.700 inches

NOTES:

1. The standard receiver decoding setup is as follows:

Command Output	Input Tone(s)
OPTIONAL	2 and 5 "ON"
ARM	1 and 5 "ON"
DESTRUCT	1 and 5 "ON", 5 "OFF", 2 "ON" or 1 and 5 "ON", 2 "ON", 5 "OFF"
MONITOR	5 "ON"

The tones are standard IRIG tones as specified in RCC Document 313-89.

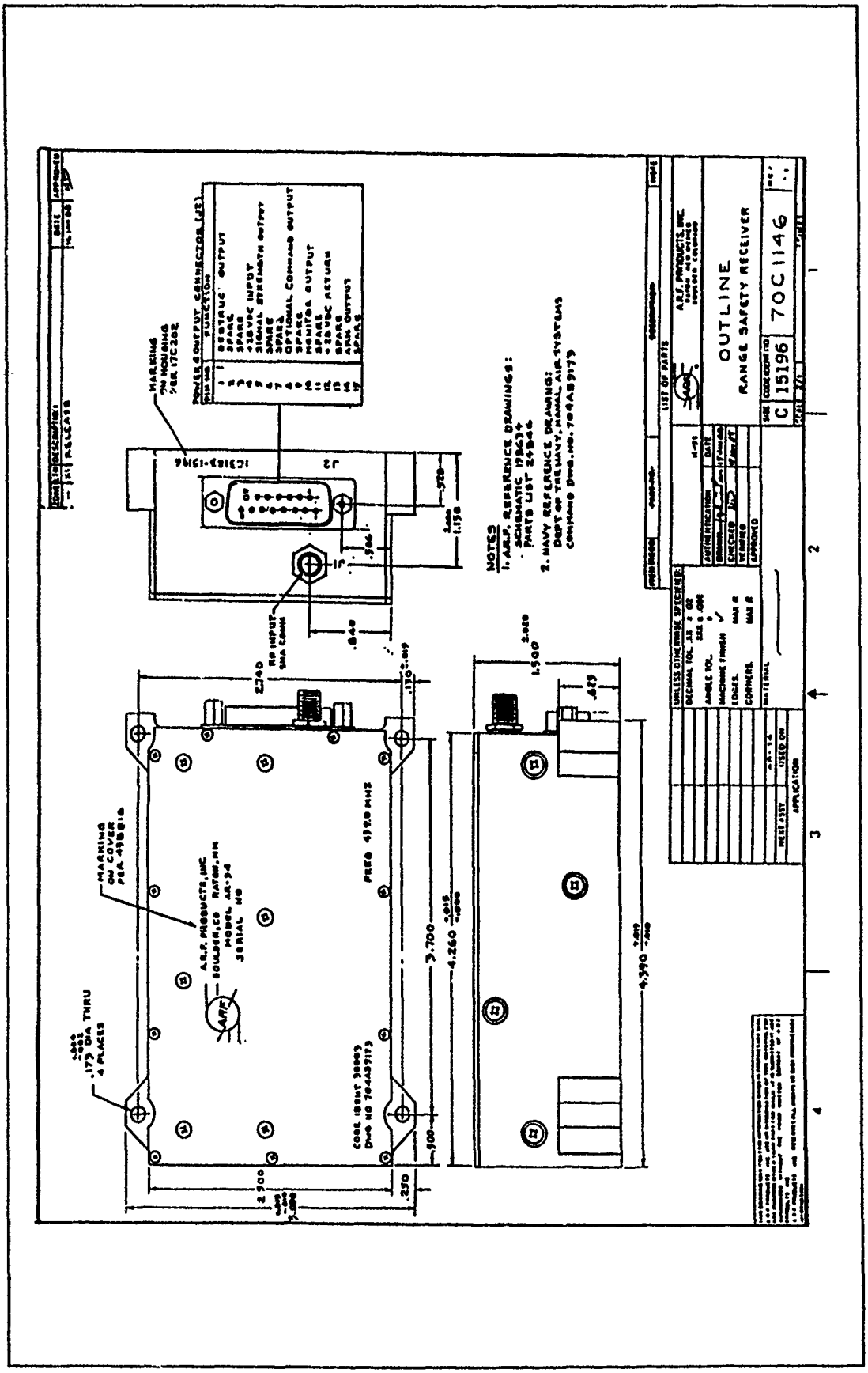


Figure 1-4. A.R.F. Model AR-34 Range Safety Receiver.

2. AYDIN VECTOR DIVISION
Post Office Box 328
Newtown, Pennsylvania 18940-0328
(Phone: 215-968-4271)

FLIGHT TERMINATION RECEIVERS/DECODERS

Model VFTR-300

Model VFTR-301

Model VFTR-321

COMMAND AND CONTROL RECEIVERS/DECODERS

Model RCC-100/TDC-100

Model RCC-200/TDC-100

Model RCC-500

AYDIN VECTOR DIVISION

FLIGHT TERMINATION RECEIVER/DECODER

MODEL VFTR-300

1. GENERAL DESCRIPTION

The Vector Model VFTR-300 Receiver/Decoder is specifically designed to meet the stringent electrical, environmental, and reliability requirements of missile flight termination usage. The receiver/decoder completely satisfies the requirements of Range Commanders Council (RCC) Document 313-89, *Design, Performance and Test Standards for Flight Termination Receiver/Decoders, Volume I, Design and Performance Requirements*. It employs standard missile range logic for three or four tones with up to four double-pole, double-throw (DPDT) relays. Flexibility of decoder circuitry allows the use of various logic schemes, including loss of carrier and prime power fail-safes.

An ultrahigh reactive quality (Q) preselector and high intermediate frequency (IF) allow the use of a simple single-heterodyne receiver front end, which is both more cost effective and reliable than alternate approaches. Components preceding the IF filter have sufficient dynamic range and power output capability to meet susceptability requirements of RCC Document 313-89 and MIL-STD-461/462. Front end gain and noise tolerance provide a threshold sensitivity of better than 1 microvolt (μV). Required selectivity is assured by use of an IF filter with a 60 decibel (dB) bandwidth of less than 350 kilohertz (kHz).

Refinement of decoder design has eliminated the common problems of unstable bandwidth center frequency at decoder threshold, resulting in a virtually rectangular filter characteristic with a very stable threshold. In the interest of reliability, no tuned audio inductors are used.

Modular packaged subassemblies are rigidly mounted in the 16-in^3 housing, which provides mechanical support as well as internal shielding for electromagnetic interference (EMI) considerations and ease of assembly. Machined compartment walls sufficiently stiffen and rigidize this light-weight structure and maximize vibration resonance frequencies. MIL-grade staking compounds preclude relative component movement, preventing vibration lead fatigue and mechanical detuning of critical circuits. Parts were selected for a maximum reliability and minimum stress. Hermetic parts are used exclusively. Vector manufactures hybrids screened to MIL-STD-883, ultrastable resistors and capacitors (when required) and MIL-STD parts are used throughout. Optional design packages as high reliability components (S-level, MIL-STD-883B, JANTXV), audio output are available upon request. All VFTR-300 receivers/decoders are extensively tested (including vibration and temperature) before shipment.

2. BACKGROUND

The VFTR-300 was developed under a company sponsored independent research and development (IR&D) program for specific use as a flight termination receiver. Among programs that the VFTR-300 was qualified on are: AMRAAM, HARM, ALARM, PERSHING, DELILA, and ARROW.

3. TECHNICAL SPECIFICATIONS

3.1	RF SECTION	
3.1.1	Frequency Range (Tuneable)	400 to 550 MHz
3.1.2	Threshold Sensitivity (Command Output)	1 μV
3.1.3	Maximum Useable RF Input	2 Vrms
3.1.4	Operating Bandwidth	±45 kHz minimum
3.1.5	Antenna Impedance	50 ohms
3.1.6	VSWR	2:1 maximum
3.1.7	Local Oscillator Stability	0.003 percent
3.1.8	Tuning Accuracy	0.005 percent
3.1.9	Tuning Method	Crystal-controlled local oscillator
3.2	IF SECTION	
3.2.1	IF Frequency	21.4 MHz
3.2.2	Selectivity, 60 dB	±180 kHz minimum; other available
3.2.3	Capture Ratio	1 dB maximum
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	3 dB, 5 to 100 kHz
3.3.2	Audio Amplifier Distortion	≤5 percent

3.3.3	Audio Output	Optional
3.3.4	Frequency Deviation	±27 to ±33 kHz per tone for activation
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	Up to 4
3.4.2	Number of Simultaneous Useable Tones	Up to 4
3.4.3	Tone Channel Bandwidth	±1 percent, 2 dB maximum; ±4 percent, 20 dB maximum
3.4.4	Adjacent Channel Rejection	Infinite
3.4.5	Decoder Threshold Deviation	±4 kHz minimum per tone for no command
3.5	OUTPUT	
3.5.1	Types of Output	Relay closure, solid-state optional
3.5.2	Output Current Capability	2 A resistive at 28 Vdc per contact
3.5.3	Output Leakage	1,000 Mohms minimum insulation resistance per contact set
3.5.4	Logic Circuit	1 & 5 = Arm; 2 & 5 = opt. Command & Monitor; 1 & 5 ON, 5 OFF, 2 ON = Arm and Destruct; 5 = Monitor, other sequences and circuits, including fail-safes, available
3.5.5	Response Time for Commands	25 ms maximum; other response times available
3.5.6	Transition Time Between Commands	3 ms
3.5.7	Output Isolation	Common ground; isolation available for some options
3.5.8	Noise Immunity	Interruption of primary power or carrier will not cause decoder operation
3.5.9	Telemetry Outputs	Signal level indication; additional status monitors optional

3.6	POWER SUPPLY	
3.6.1	Supply Voltage	22 to 36 Vdc
3.6.2	Power Requirements	Standby: 180 mA maximum Interrogate: 180 mA plus 23 mA per energized channel at 28 Vdc (30 mA per channel at 36 Vdc)
3.6.3	Power Supply Isolation	Connected to chassis; isolation optional
3.6.4	Turn-On Power Control for Receiver	Available with some configurations
3.6.5	Other Controls	Optional controls available, such as fail-safe enable
3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	MIL-STD-461/462, except limits A & B; CS04 and CS08 are 60 dB
3.7.2	Pulse Rejection	Application of C-Band and X-Band radar transponder signal of +27 dBm at the antenna will not degrade receiver sensitivity and/or cause false command output
3.7.3	AM Rejection	Application of AM carrier will not cause any command output
3.7.4	Image Rejection	60 dB minimum
3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-40°C to +77°C (-54°C to +85°C optional)
3.8.2	Nondestructive Temperatures (Shelf Storage)	-55°C to +110°C
3.8.3	Humidity	95 percent
3.8.4	Altitude	Unlimited

3.8.5	Shock	1,500 g SRS
3.8.6	Acceleration	150 g
3.8.7	Vibration (random)	21 g rms, 20 to 2,000 Hz
3.8.8	Acoustics	Not measured
3.8.9	Pressurization	Not required
3.8.10	Operating Life	≥2,000 hours
3.8.11	Shelf Life	8 years
3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	16-in^3
3.9.2	Dimensions	See Outline Drawing
3.9.3	Weight	20 ounces maximum
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	Antenna: SMA Power/Signal/Control: 15-pin per MIL-C-24308 (others available)

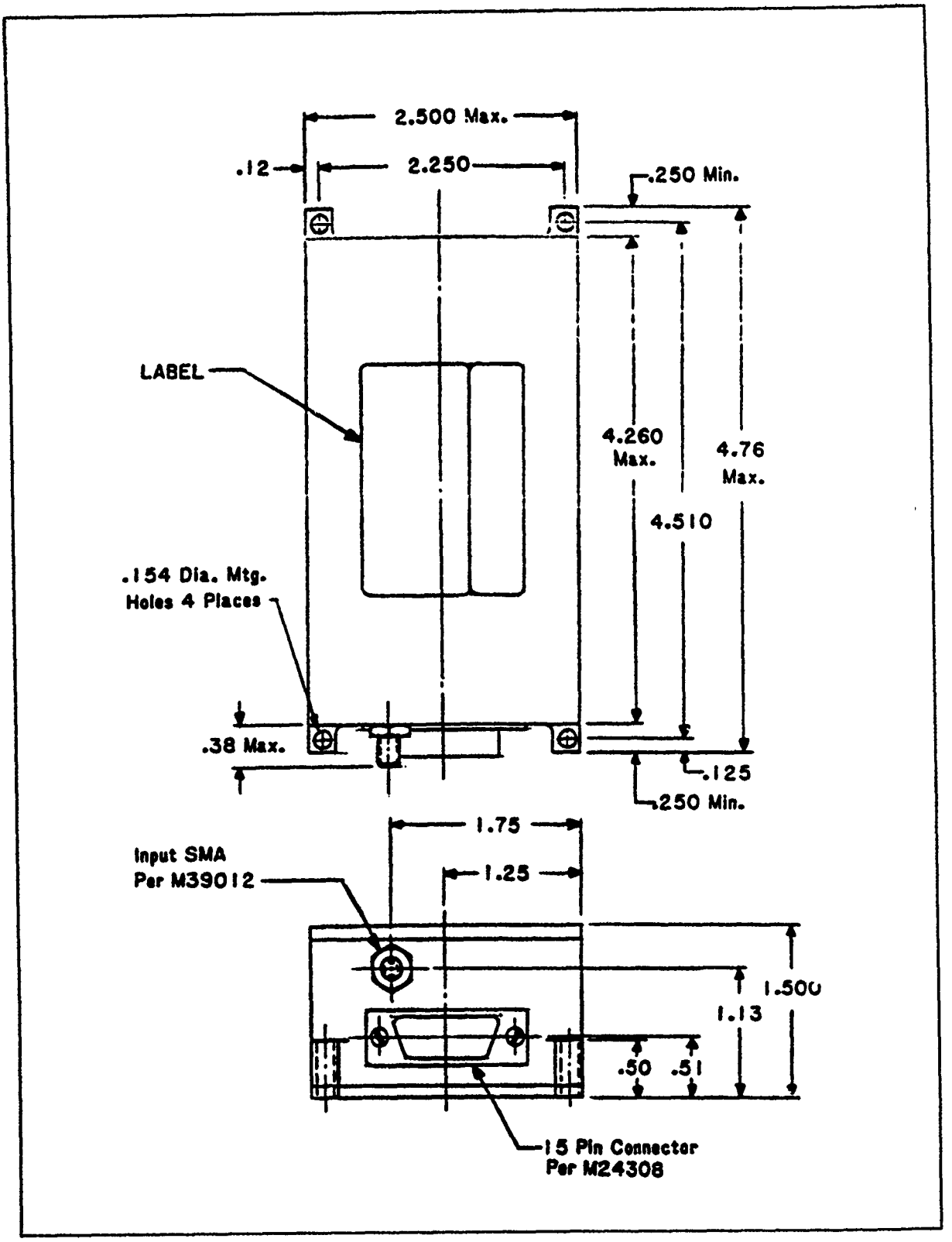


Figure 2-1. Outline drawing of Aydin Vector Division Model VFTR-300 Flight Termination Receiver/Decoder.

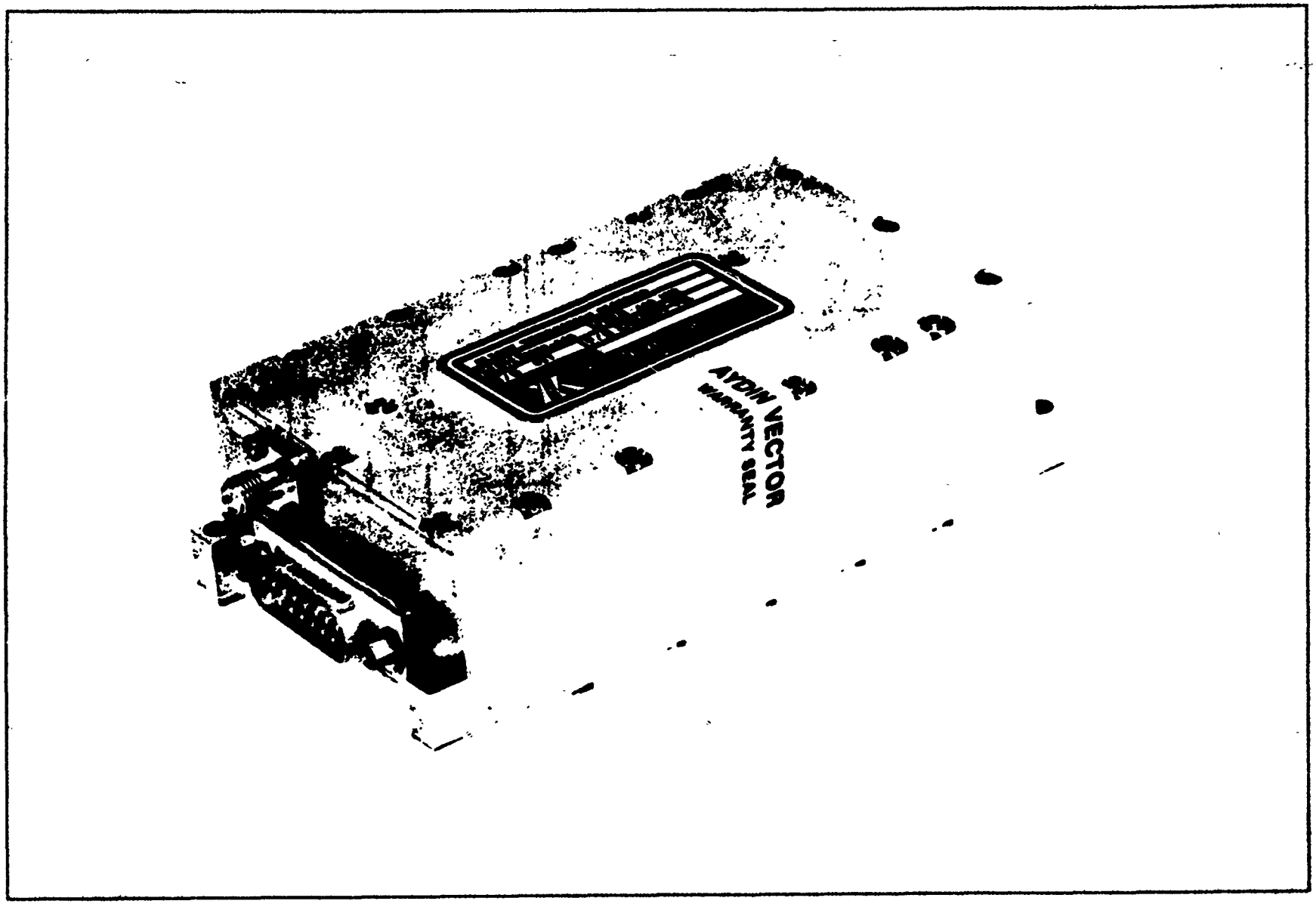


Figure 2-2. Aydin Vector Division Model VFTR-300 Flight Termination Receiver/Decoder.

AYDIN VECTOR DIVISION

FLIGHT TERMINATION RECEIVER/DECODER

MODEL VFTR-301

1. GENERAL DESCRIPTION

The Vector Model VFTR-301 Receiver/Decoder is specifically designed to meet the requirements for flight termination receivers/decoders, as specified in NAVAIRSYSCOM specifications 642AS8859 and 642AS8961. The VFTR-301 meets the stringent electrical, environmental, and reliability requirements of missile flight termination usage and completely satisfies the requirements of RCC Document 313-89. It employs standard missile range logic for three or four tones with up to four DPDT relays. Flexibility of decoder circuitry allows the use of various logic schemes, including loss of carrier and prime power fail-safes.

An ultrahigh Q preselector and high IF allow the use of a simple single-heterodyne receiver front end, which is both more cost effective and reliable than alternative approaches. Components preceding the IF filter have sufficient dynamic range and power output capability to meet the susceptability requirements of RCC Document 313-89 and MIL-STD-461/462. Front-end gain and noise tolerance provide a threshold sensitivity of better than 1 μV. Required selectivity is assured by use of a 60 dB bandwidth of less than 350 kHz.

Refinement of the decoder design has eliminated the common problems of unstable bandwidth and center frequency at decoder threshold, resulting in a virtually rectangular filter characteristic with a very stable threshold. In the interest of reliability, no tuned audio inductors are used.

Modular packaged subassemblies are rigidly mounted in the 19.2-in^3 housing, which provides mechanical support as well as internal shielding for EMI considerations and ease of assembly. Machined compartment walls sufficiently stiffen and rigidize this lightweight structure and maximize vibration resonance frequencies. MIL-grade staking compounds preclude relative component movement, preventing vibrational lead fatigue and mechanical detuning of critical circuits. Parts were selected for maximum reliability and minimum stress. Hermetic parts are used exclusively. Vector manufactures hybrids screened to MIL-STD-883, ultrastable resistors and capacitors (when required) and MIL-STD parts are used throughout. Upgraded parts and parts screening are available as options. Optional design packages as high reliability components (S-level, MIL-STD-883B, JANTXV) audio output, are available upon request. All VFTR-301 receivers/decoders are extensively tested (including vibration and temperature) before shipment.

2. BACKGROUND

The VFTR-301 is a repackaging of the VFTR-300 Receiver/Decoder. The VFTR-301 conforms to the connector, size, and mounting requirements of specifications 642AS8859 and 642AS8961. Modules incorporated in the VFTR-300 and VFTR-301 are completely interchangeable.

The VFTR-301 was developed under a company sponsored IR&D program for specific use as a missile flight termination receiver. Among programs that the VFTR-301 was qualified on are: VANDAL, TACIT RAINBOW, and PEGASUS.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	400 to 475 MHz or 475 to 550 MHz
3.1.2	Threshold Sensitivity (Command Output)	1 µV
3.1.3	Maximum Useable RF Input	2 Vrms
3.1.4	Operating Bandwidth	±45 kHz minimum
3.1.5	Antenna Impedance	50 ohms
3.1.6	VSWR	2:1 maximum
3.1.7	Local Oscillator Stability	0.003 percent
3.1.8	Tuning Accuracy	0.005 percent
3.1.9	Tuning Method	Crystal-controlled local oscillator

3.2 IF SECTION

3.2.1	IF Frequency	21.4 MHz
3.2.2	Selectivity, 60 dB	±180 kHz maximum; other available
3.2.3	Capture Ratio	1 dB maximum

3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	3 dB, 5 to 100 kHz
3.3.2	Audio Amplifier Distortion	≤5 percent
3.3.3	Audio Output	Optional
3.3.4	Frequency Deviation	±27 to ±33 kHz per tone for activation
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	Up to 4
3.4.2	Number of Simultaneous Useable Tones	Up to 4
3.4.3	Tone Channel Bandwidth	±1 percent, 2 dB minimum; ±4 percent, 20 dB maximum
3.4.4	Adjacent Channel Rejection	Infinite
3.4.5	Decoder Threshold Deviation	±4 kHz minimum per tone for no command
3.5	OUTPUT	
3.5.1	Types of Output	Relay closure, solid-state optional
3.5.2	Output Current Capability	2 A resistive at 28 Vdc per contact
3.5.3	Output Leakage	1,000 Mohms minimum insulation resistance per contact set
3.5.4	Logic Circuit	1 & 5 = Arm; 2 & 5 = opt. Command & Monitor; 1 & 5 ON, 5 OFF, 2 ON = Arm and Destruct; 5 = Monitor; other sequences and circuits, including fail-safes, available
3.5.5	Response Time for Commands	25 ms maximum; other response times available
3.5.6	Transition Time Between Commands	3 ms

3.5.7	Output Isolation	Common ground; isolation available for some options
3.5.8	Noise Immunity	Interruption of primary power or carrier will not cause decoder operation
3.5.9	Telemetry Outputs	Signal level indication; additional status monitors optional
3.6	POWER SUPPLY	
3.6.1	Supply voltage	22 to 36 Vdc
3.6.2	Power Requirements	Standby: 180 mA maximum Interrogate: 180 mA plus 23 mA per energized channel at 28 Vdc (30 mA per channel at 36 Vdc)
3.6.3	Power Supply Isolation	Connected to chassis; isolation optional
3.6.4	Turn-On Power Control for Receiver	Available with some configurations
3.6.5	Other Controls	Optional controls available, such as fail-safe enable
3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	MIL-STD-461/462, except limits A & B; CS04 and CS08 are 60 dB
3.7.2	Pulse Rejection	Application of C-Band and X-Band radar transponder signal of +27 dBm at the antenna will not degrade receiver sensitivity and/or cause false command output
3.7.3	AM Rejection	Application of AM carrier will not cause any command output
3.7.4	Image Rejection	60 dB minimum

3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-40°C to +77°C (-54°C to +85°C optional)
3.8.2	Nondestructive Temperatures (Shelf Storage)	-55°C to +110°C
3.8.3	Humidity	95 percent
3.8.4	Altitude	Unlimited
3.8.5	Shock	1,500 g SRS
3.8.6	Acceleration	150 g
3.8.7	Vibration	21 g rms random, 20 to 2,000 Hz
3.8.8	Acoustics	Not measured
3.8.9	Pressurization	Not required
3.8.10	Operating Life	≥2,000 hours
3.8.11	Shelf Life	8 years
3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	16-in^3
3.9.2	Dimensions	See Outline Drawing
3.9.3	Weight	25 ounces maximum
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	J1: Antenna - TNC Receptacle J2: MS3112E-8-4P J3: MS3112E-10-6S J4: MS3112E-8-4S

TABLE 2-1

PIN CONNECTION OPTIONS FOR VFTR-301

CONNECTOR	PIN	VFTR-301A	VFTR-301B
J1		TNC	TNC
J2	A	+28 Vdc	+28 Vdc
	B	28 V RTN	28 V RTN
	C	Case End	Case End
	D	Spare	Spare
J3	A	MON Out	MON Out
	B	OPT Command	OPT Command
	C	MON RTN	MON RTN
	D	OPT Command RTN	OPT Command RTN
	E	ARM RTN	OPT Command RTN
	F	ARM Out	ARM Command
J4	A	SIG STR	SIG STR
	B	SIG STR RTN	SIG STR RTN
	C	DEST Out	Term Command
	D	DEST RTN	Term Command RTN
SPEC		642AS8961	642AS8859

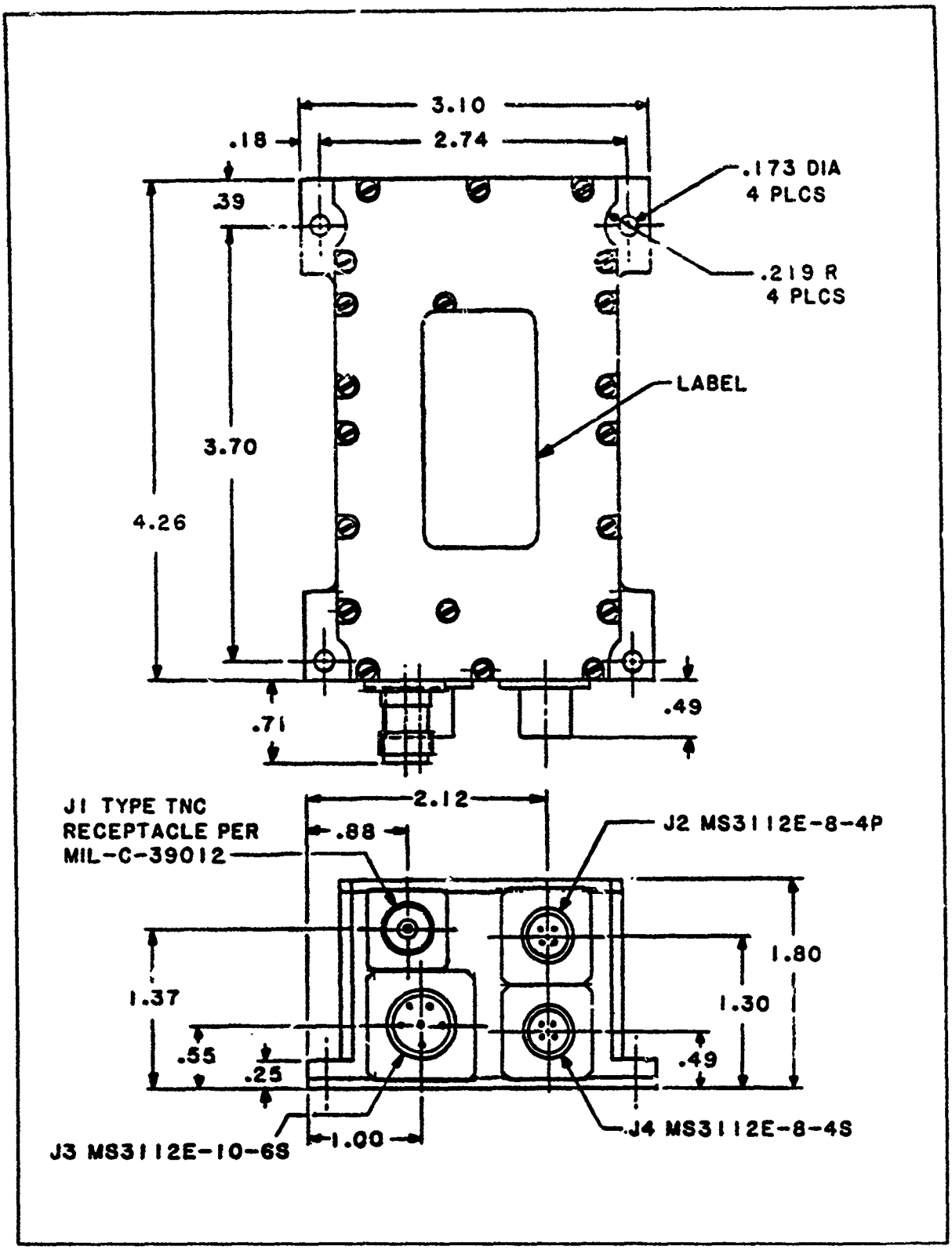


Figure 2-3. Outline drawing of Aydin Vector Division Model VFTR-301 Flight Termination Receiver/Decoder.

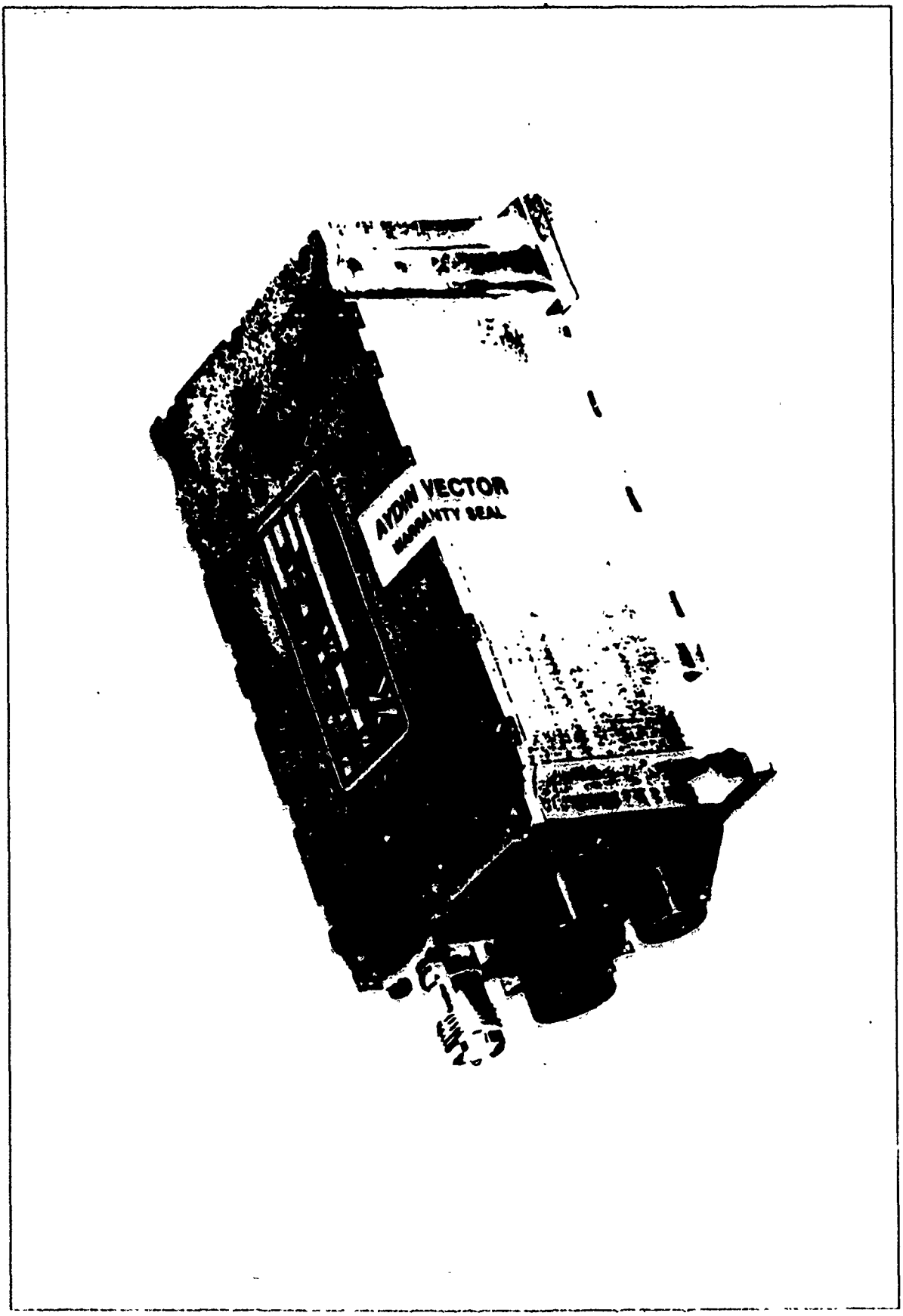


Figure 2-4. Aydin Vector Division Model VFTR-301 Flight Termination Receiver/Decoder.

AYDIN VECTOR DIVISION

MINIATURE FLIGHT TERMINATION RECEIVER/DECODER

MODEL VFTR-321

1. GENERAL DESCRIPTION

The Vector Model VFTR-321 Receiver/Decoder is specifically designed to meet the requirements of todays missile and Remote Piloted Vehicle (RPV) for lighter weight and smaller size while maintaining the stringent electrical, environmental, and reliability of the VFTR-300 and VFTR-301 series.

The receiver/decoder is designed to meet the requirements of RCC Document 313-89; *Design, Performance and Test Standards for Flight Termination Receiver/Decoders, Volume I, Design and Performance Requirements*. It features an Erasable Programmable Logic Device (EPLD) which could be easily programmed (or reprogrammed) to meet standard missile range logic or any other requirement.

An ultrahigh reactive quality (Q) preselector and high IF allow the use of a simple single-heterodyne receiver front end, which is both more cost effective and reliable than alternative approaches. Components preceding the IF filter have sufficient dynamic range and power output capability to meet the susceptability requirements of RCC Document 313-89 and MIL-STD-461/462. Front-end gain and noise tolerance provide a threshold sensitivity of better than 1 μV. Required selectivity is assured by use of an IF crystal filter with a 60 dB bandwidth of less than 350 kHz.

Optimization of the Phase Lock Loop (PLL) Tone Decoder guarantees bandwidth stability from threshold to maximum tone deviation, resulting in virtually rectangular filter characteristics.

Modular packaged subassemblies are rigidly mounted in the 6.25-in^3 housing, which provides mechanical support as well as internal shielding for EMI considerations and ease of assembly. Machined compartment walls sufficiently stiffen and rigidize this lightweight structure and maximize vibration resonance frequencies. MIL-grade staking compounds preclude relative component movement, preventing vibrational lead fatigue and mechanical detuning of critical circuits. Parts were selected for maximum reliability and minimum size and stress. To comply with minimum size and weight, Vector designed hybrids are used. When required, high reliability parts S-level, MIL-STD-883B, JANTX could be used.

2. BACKGROUND

The VFTR-321 was developed under a company sponsored IR&D program for specific use as a miniature flight termination receiver.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	400 to 550 MHz
3.1.2	Threshold Sensitivity (Command Output)	1 µV
3.1.3	Maximum Useable RF Input	2 Vrms
3.1.4	Operating Bandwidth	±45 kHz minimum
3.1.5	Antenna Impedance	50 ohms
3.1.6	VSWR	2:1 maximum
3.1.7	Local Oscillator Stability	0.003 percent
3.1.8	Tuning Accuracy	0.005 percent
3.1.9	Tuning Method	Crystal-controlled local oscillator

3.2 IF SECTION

3.2.1	IF Frequency	21.4 MHz
3.2.2	Selectivity, 60 dB	±180 kHz maximum; other available
3.2.3	Capture Ratio	1 dB maximum

3.3 AUDIO SECTION

3.3.1	Audio Amplifier Response	3 dB, 5 to 100 kHz
3.3.2	Audio Amplifier Distortion	≤5 percent
3.3.3	Audio Output	Optional
3.3.4	Frequency Deviation	±27 to ±33 kHz per tone for activation

3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	Up to 4
3.4.2	Number of Simultaneous Useable Tones	Up to 4
3.4.3	Tone Channel Bandwidth	±1 percent, 2 dB minimum; ±4 percent, 20 dB maximum
3.4.4	Adjacent Channel Rejection	Infinite
3.4.5	Decoder Threshold Deviation	±4 kHz minimum per tone for no command; optional deviations are available
3.5	OUTPUT	
3.5.1	Types of Output	Relay closure, solid-state optional
3.5.2	Output Current Capability	2 A resistive at 28 Vdc per contact
3.5.3	Output Leakage	1,000 Mohms minimum insulation resistance per contact set
3.5.4	Logic Circuit	1 & 5 = Arm; 2 & 5 = opt. Command & Monitor; 1 & 5 ON, 5 OFF, 2 ON = Arm and Destruct; 5 = Monitor; other sequences and circuits, including fail-safes, available
3.5.5	Response Time for Commands	25 ms maximum; other response times available
3.5.6	Transition Time Between Commands	3 ms
3.5.7	Output Isolation	All output returns isolated from case ground
3.5.8	Noise Immunity	Interruption of primary power or carrier will not cause decoder operation
3.5.9	Telemetry Outputs	Signal level indication; additional status monitors optional

3.6	POWER SUPPLY	
3.6.1	Supply voltage	22 to 36 Vdc
3.6.2	Power Requirements	Standby: 180 mA maximum Interrogate: 180 mA plus 23 mA per energized channel at 28 Vdc (30 mA per channel at 36 Vdc)
3.6.3	Power Supply Isolation	Isolated from chassis; chassis ground optional
3.6.4	Turn-On Power Control for Receiver	Available with some configurations
3.6.5	Other Controls	Optional controls available, such as fail-safe enable
3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	MIL-STD-461/462, except limits A & B; CS04 and CS08 are 60 dB
3.7.2	Pulse Rejection	Application of C-Band and X-Band radar transponder signal of +27 dBm at the antenna will not degrade receiver sensitivity and/or cause false command output
3.7.3	AM Rejection	Application of AM carrier will not cause any command output
3.7.4	Image Rejection	60 dB minimum
3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-40°C to +77°C (-54°C to +85°C optional)
3.8.2	Nondestructive Temperatures (Shelf Storage)	-55°C to +110°C
3.8.3	Humidity	95 percent
3.8.4	Altitude	Unlimited

3.8.5	Shock	1,500 g SRS
3.8.6	Acceleration	150 g
3.8.7	Vibration	21 g rms random, 20 to 2,000 Hz
3.8.8	Acoustics	Not measured
3.8.9	Pressurization	Not required
3.8.10	Operating Life	≥2,000 hours
3.8.11	Shelf Life	8 years
3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	6.25-in^3
3.9.2	Dimensions	See Outline Drawing
3.9.3	Weight	8 ounces maximum
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	Antenna - SMA Power/Signal/Control: 15-pin per MIL-C-24308 (others available)

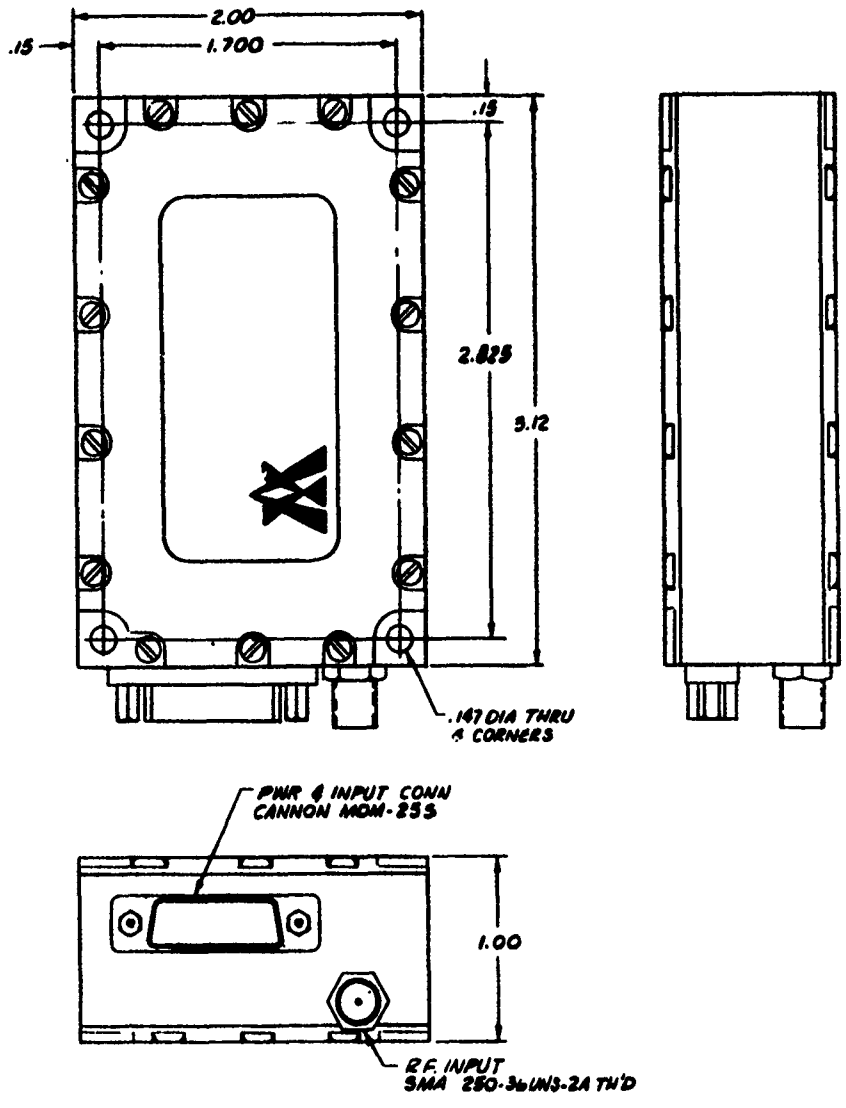


Figure 2-5. Outline drawing of Aydin Vector Division Model VFTR-321 Flight Termination Receiver.

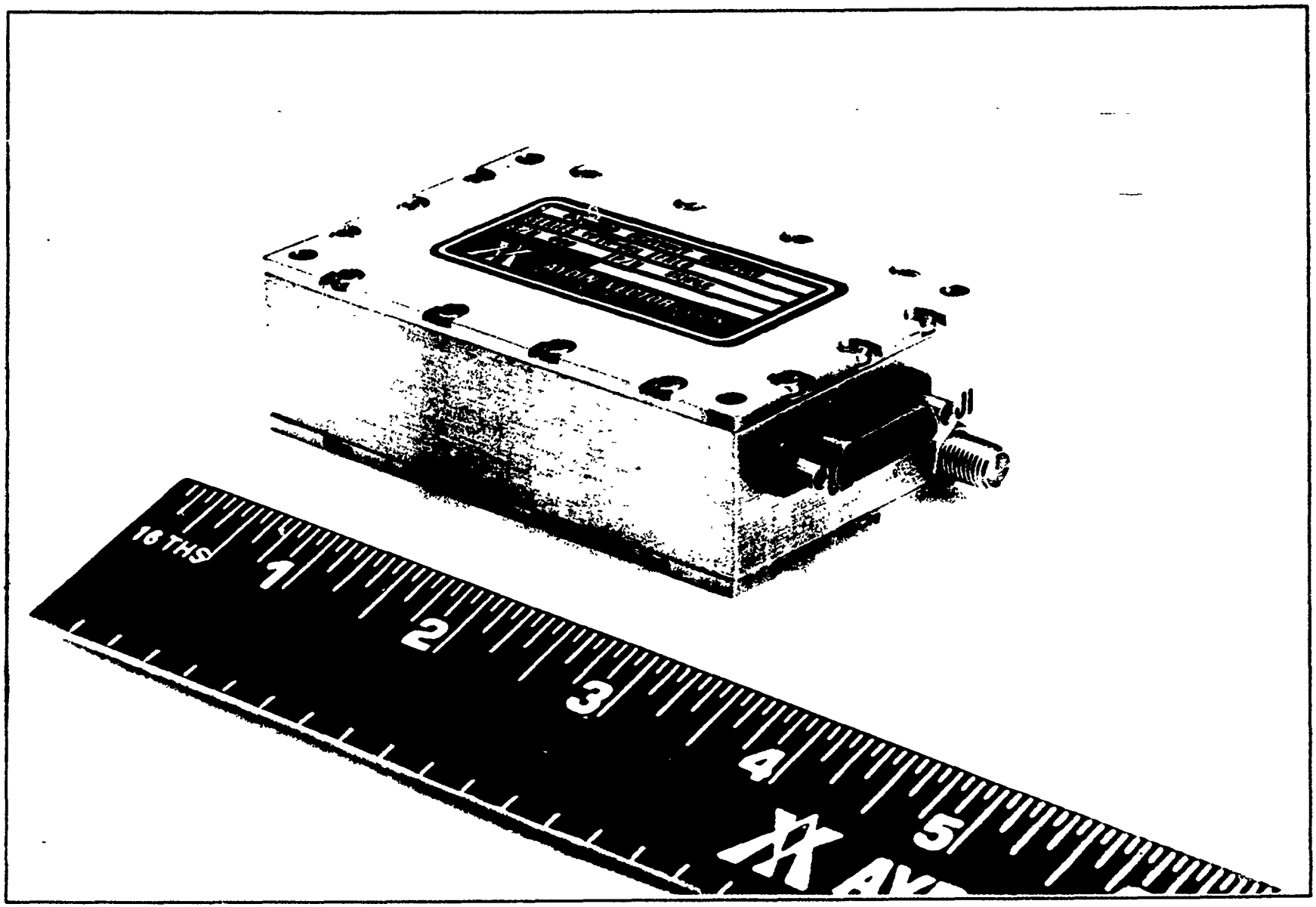


Figure 2-6. Aydin Vector Division Model VFTR-321 Flight Termination Receiver/Decoder.

AYDIN VECTOR DIVISION

COMMAND AND CONTROL RECEIVER/DECODER

MODEL RCC-100/TDC-100

1. GENERAL DESCRIPTION

The Vector Model RCC-100 Series Very High Frequency (VHF) Command and Control Receivers are designed for operation in the 200- to 550-MHz band for aerospace applications where size, weight, ruggedness and power consumption are critical. The receiver is compatible with the majority of communication and telemetry FM data links (such as voice, FM/FM, Pulse Amplitude Modulation (PAM)/FM, and Pulse Code Modulation (PCM)/FM). The Vector TDC-100 Tone Decoder directly interfaces mechanically and electrically with the RCC-200 for command and control applications with up to four tones. The RCC-100 has mounting provisions for stacking one or more TDC-100 modules for operation with more than four tones.

2. BACKGROUND

The RCC-100/TDC-100 Receivers/Decoders have been successfully flown on numerous National Aeronautics and Space Administration (NASA), military, foreign and commercial programs with communications, telemetry, and command and control applications.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	RCC-101: 200 to 290 MHz RCC-102: 290 to 400 MHz RCC-103: 400 to 550 MHz
3.1.2	Threshold Sensitivity (Command Output)	3 µV maximum for decoder operation with 200 kHz IF filter
3.1.3	Maximum Useable RF Input	2 Vrms maximum
3.1.4	Operating Bandwidth	±45 kHz with 200 kHz, 3 dB IF bandwidth and up to 4 simultaneous tones (wider for other filters - 400-, 600-, 800-, 1,000-kHz and others available)
3.1.5	Antenna Impedance	50 ohms

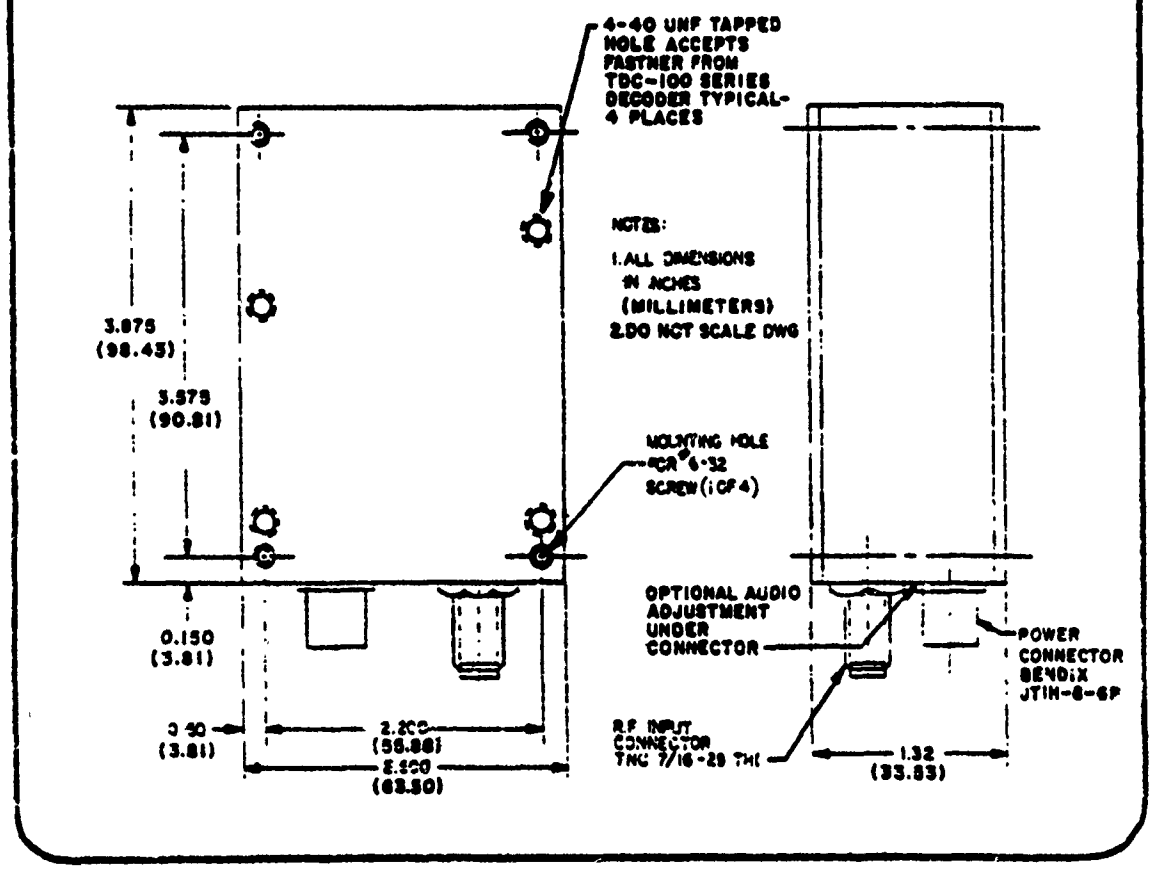
3.1.6	VSWR	2:1 maximum
3.1.7	Local Oscillator Stability	±0.003 percent
3.1.8	Tuning Accuracy	±0.005 percent
3.1.9	Tuning Method	Crystal-controlled local oscillator
3.2	IF SECTION	
3.2.1	IF Frequency	21.4 MHz
3.2.2	Selectivity, 60 dB	3.75 times 3 dB IF bandwidth
3.2.3	Capture Ratio	1 dB with decoder
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	100 Hz to 1/4 times 3 dB IF bandwidth (±1 dB)
3.3.2	Audio Amplifier Distortion	2 percent maximum for peak-to-peak deviation of 1/4 times 3 dB IF bandwidth
3.3.3	Audio Output	0.01 V peak per kHz deviation into 600 ohm load
3.3.4	Frequency Deviation	Up to 1.5 MHz peak-to-peak (depending on IF filter)
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	Up to 4 per TDC-100 housing (housings stackable)
3.4.2	Number of Simultaneous Useable Tones	Up to 4 with 200 kHz IF bandwidth (more tones with wider bandwidth)
3.4.3	Tone Channel Bandwidth	±1 percent, 2 dB minimum; ±4 percent, 20 dB maximum

3.4.4	Adjacent Channel Rejection	34 dB minimum
3.4.5	Decoder Threshold Deviation	±4 kHz minimum per tone for no command; ±27 to ±33 kHz per tone for activation
3.5	OUTPUT	
3.5.1	Types of Output	Relay closure for decoder output
3.5.2	Output Current Capability	2 A resistive at 28 Vdc
3.5.3	Output Leakage	1,000 Mohms minimum insulation resistance per relay contact
3.5.4	Logic Circuit	Two contacts per channel (DPDT); internal logic sequence optional
3.5.5	Response Time for Commands	25 ms maximum
3.5.6	Transition Time Between Commands	3 ms
3.5.7	Output Isolation	Common ground; isolation optional
3.5.8	Noise Immunity	Interruption of primary power or carrier will not cause decoder operation
3.5.9	Telemetry Outputs	Signal level indication (0 to 4 Vdc nominal into 10 kohms)
3.6	POWER SUPPLY	
3.6.1	Supply Voltage	24 to 36 Vdc
3.6.2	Power Requirements	RCC-100: 60 mA maximum TDC-100: 10 mA plus 15 mA per decoder channel (plus 23 mA per energized relay)
3.6.3	Power Supply Isolation	Returns connected to chassis; isolation optional

3.6.4	Turn On Power Control for Receiver	N/A
3.6.5	Other Controls	None
3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	MIL-STD-461B, except limits A & B; CS04 is 40 dB
3.7.2	Pulse Rejection	Not measured
3.7.3	AM Rejection	Not measured
3.7.4	Image Rejection	60 dB minimum
3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-40°C to +70°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-50°C to +90°C
3.8.3	Humidity	95 percent
3.8.4	Altitude	Unlimited
3.8.5	Shock	1/2 sine at 50 g for 11 ms
3.8.6	Acceleration	100 g
3.8.7	Vibration	20 g sine, 20 to 2,000 Hz
3.8.8	Acoustics	Not measured
3.8.9	Pressurization	Not required
3.8.10	Operating Life	>1,500 hours
3.8.11	Shelf Life	5 years

3.9 PHYSICAL CHARACTERISTICS

3.9.1	Volume	RCC-100: 12.8-in^3 TDC-100: 7.3-in^3
3.9.2	Dimensions	See Outline Drawing (units stackable)
3.9.3	Weight	RCC-100: 13.0 ounces maximum TDC-100: 7.5 ounces maximum
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	RCC-100 - Power and output: Bendix JTIH-8-6P RF input: TNC female TDC-100 - 1- to 3-channel: Cannon DBH25P102 4-channel: Cannon MDM37S

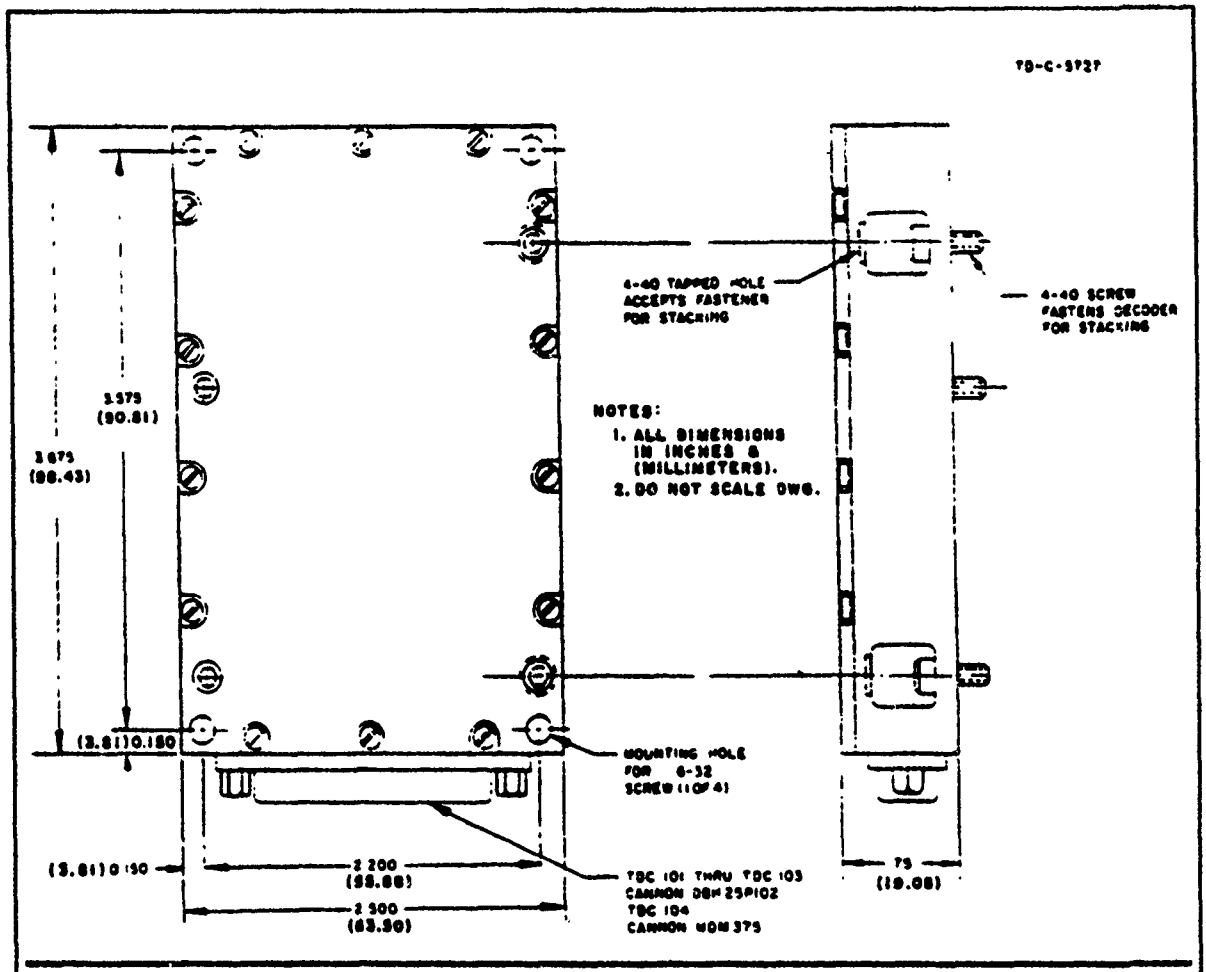


PIN CONNECTIONS

POWER AND OUTPUT CONNECTOR

PIN NO.	FUNCTION
1	+28V
2	Power Return
3	Case Ground
4	Audio Out
5	Signal Return
6	Signal Strength Monitor

Figure 2-7. Outline drawing and pin connections of Aydin Vector Division Model RCC-100 Command and Control Receiver.



Channel No.	Center Frequency (Hz)	Channel No.	Center Frequency (Hz)
1	7,500	11	25,010
2	8,460	12	28,210
3	9,540	13	31,830
4	10,760	14	35,900
5	12,140	15	40,490
6	13,700	16	45,680
7	15,450	17	51,320
8	17,430	18	53,120
9	19,660	19	65,560
10	22,170	20	73,950

Figure 2-8. Outline drawing and channel frequencies of Aydin Vector Division TDC-100 Series Tone Decoders.

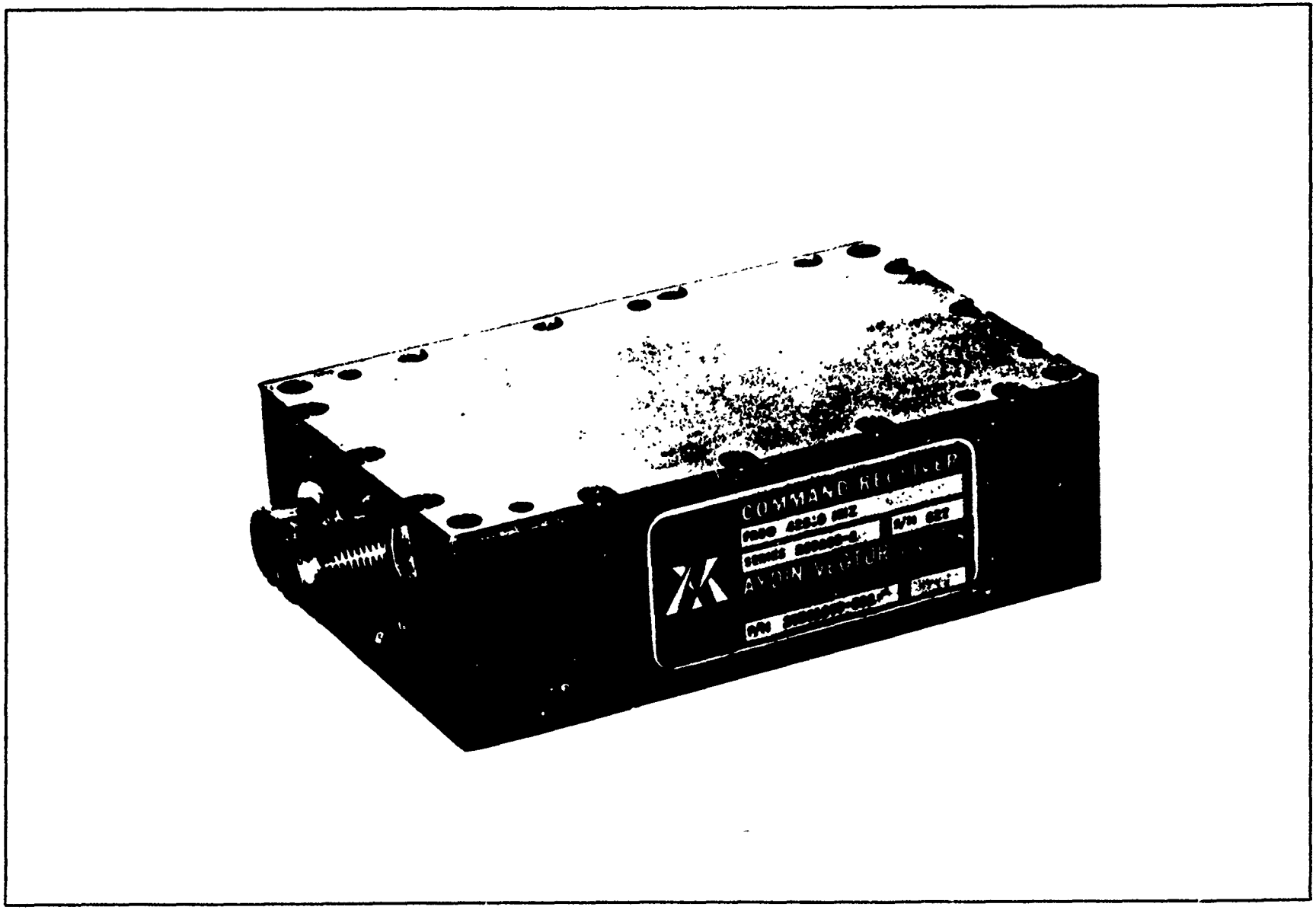


Figure 2-9. Aydin Vector Division Model RCC-103-1 Command and Control Receiver.

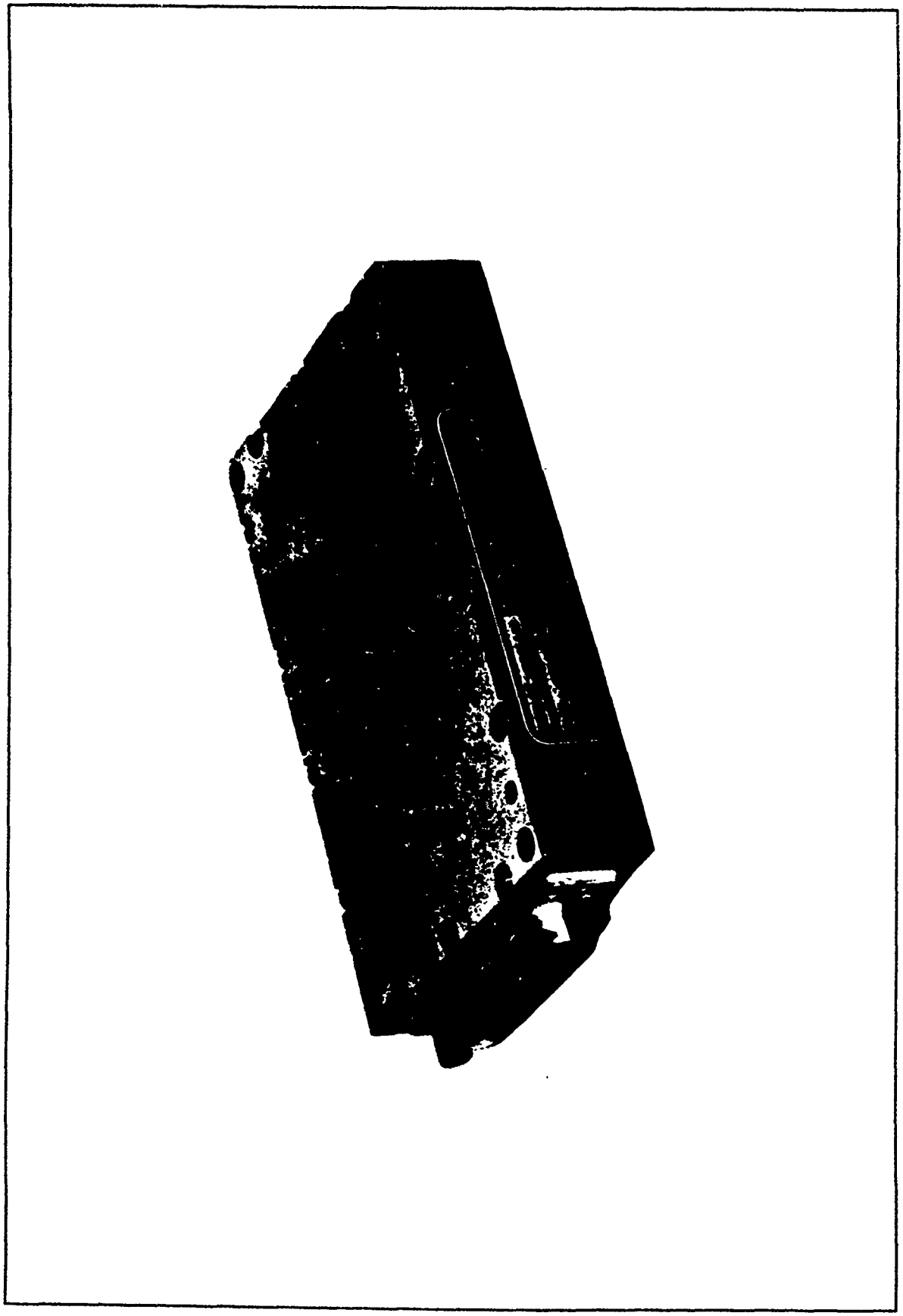


Figure 2-10. Aydin Vector Division Model TDC-103 Tone Decoder.

AYDIN VECTOR DIVISION

COMMAND AND CONTROL RECEIVER/DECODER

MODEL RCC-200/TDC-100

1. GENERAL DESCRIPTION

The Vector Model RCC-200 Series double-superheterodyne Ultrahigh-Frequency (UHF) Command and Control Receivers are designed for operation in the 1435- to 2400-MHz band for aerospace applications where size, weight, ruggedness and power consumption are critical. The receiver is compatible with the majority of communication and telemetry FM data links (such as voice, FM/FM, PAM/FM, and PCM/FM). The Vector TDC-100 Tone Decoder directly interfaces mechanically and electrically with the RCC-200 for command and control applications with up to four tones. The RCC-200 has mounting provisions for stacking one or more TDC-100 modules for operation with more than four tones.

2. BACKGROUND

The RCC-200/TDC-100 Receivers/Decoders have been successfully flown on numerous National Aeronautics and Space Administration (NASA), military, foreign and commercial programs with communications, telemetry, and command and control applications.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	RCC-201: 1435 to 1540 MHz RCC-202: 1710 to 1850 MHz RCC-203: 2200 to 2300 MHz RCC-204: 2300 to 2400 MHz
3.1.2	Threshold Sensitivity (Command Output)	5 µV maximum for decoder operation with 200 kHz IF filter
3.1.3	Maximum Useable RF Input	2 Vrms maximum
3.1.4	Operating Bandwidth	±45 kHz with 200 kHz, 3 dB IF bandwidth and up to 4 simultaneous tones (wider for other filters - 400-, 600-, 800-, 1,000-kHz and others available)
3.1.5	Antenna Impedance	50 ohms

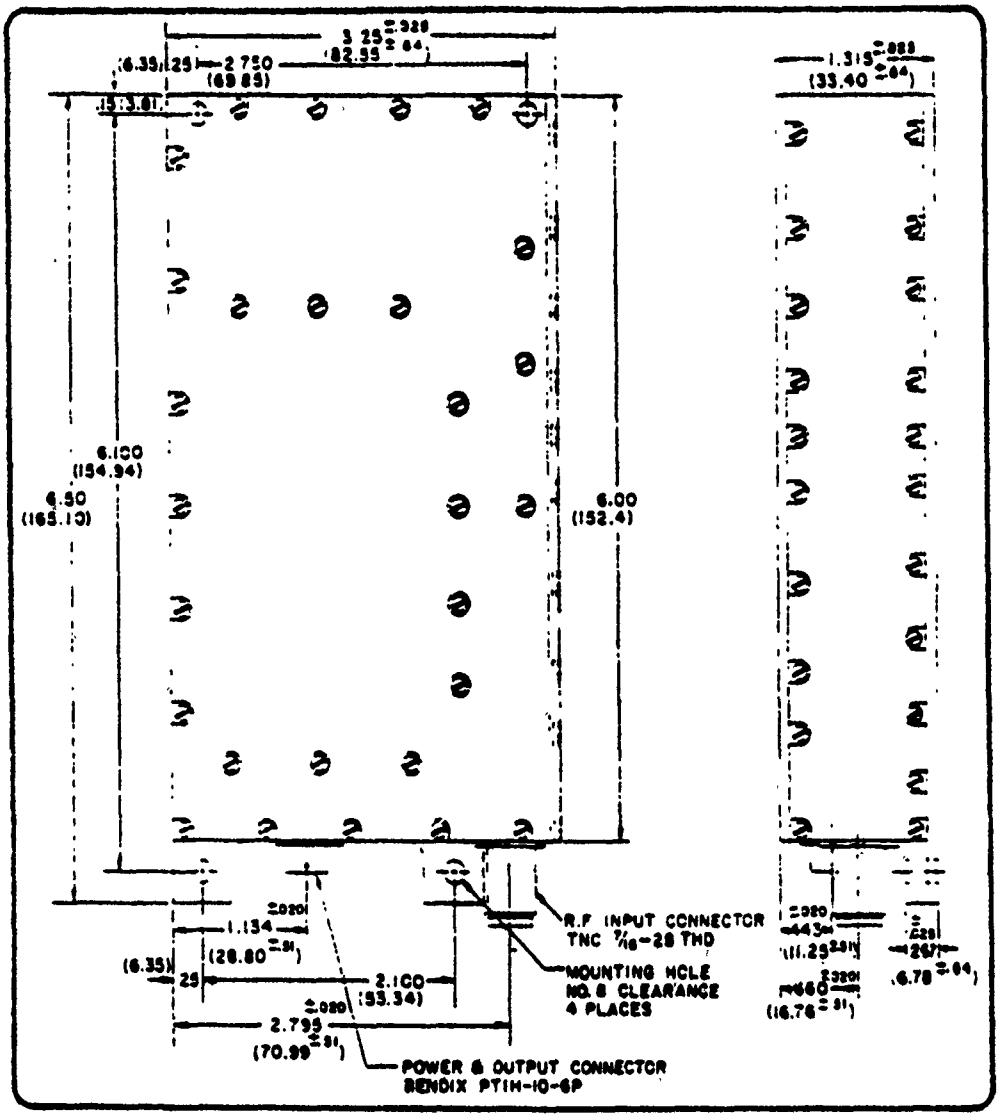
3.1.6	VSWR	2:1 maximum
3.1.7	Local Oscillator Stability	±0.003 percent
3.1.8	Tuning Accuracy	±0.005 percent
3.1.9	Tuning Method	Crystal-controlled local oscillator
3.2	IF SECTION	
3.2.1	IF Frequency	21.4 MHz
3.2.2	Selectivity, 60 dB	3.75 times 3 dB IF bandwidth
3.2.3	Capture Ratio	1 dB with decoder
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	100 Hz to 1/4 times 3 dB IF bandwidth (±1 dB)
3.3.2	Audio Amplifier Distortion	2 percent maximum for peak-to-peak deviation of 1/4 times 3 dB IF bandwidth
3.3.3	Audio Output	0.01 V peak per kHz deviation into 600 ohm load
3.3.4	Frequency Deviation	Up to 1.5 MHz peak-to-peak (depending on IF filter)
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	Up to 4 per TDC-100 housing (housings stackable)
3.4.2	Number of Simultaneous Useable Tones	Up to 4 with 200 kHz IF bandwidth (more tones with wider bandwidth)
3.4.3	Tone Channel Bandwidth	±1 percent, 2 dB minimum; ±4 percent, 20 dB maximum

3.4.4	Adjacent Channel Rejection	34 dB minimum
3.4.5	Decoder Threshold Deviation	±4 kHz minimum per tone for no command; ±27 to ±33 kHz per tone for activation
3.5	OUTPUT	
3.5.1	Types of Output	Relay closure for decoder output
3.5.2	Output Current Capability	2 A resistive at 28 Vdc
3.5.3	Output Leakage	1,000 Mohms minimum insulation resistance per relay contact
3.5.4	Logic Circuit	Two contacts per channel (DPDT); internal logic sequence optional
3.5.5	Response Time for Commands	25 ms maximum
3.5.6	Transition Time Between Commands	3 ms
3.5.7	Output Isolation	Common ground
3.5.8	Noise Immunity	Interruption of primary power or carrier will not cause decoder operation
3.5.9	Telemetry Outputs	Signal strength indication (0 to 4 Vdc nominal into 10 kohms)
3.6	POWER SUPPLY	
3.6.1	Supply Voltage	24 to 36 Vdc
3.6.2	Power Requirements	RCC-200: 120 mA maximum TDC-100: 10 mA plus 15 mA per decoder channel (plus 22 mA per energized relay)
3.6.3	Power Supply Isolation	Returns connected to chassis
3.6.4	Turn-On Power Control for Receiver	N/A
3.6.5	Other Controls	None

3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	MIL-STD-461B, except limits A & B; CS04 is 40 dB
3.7.2	Pulse Rejection	Not measured
3.7.3	AM Rejection	Not measured
3.7.4	Image Rejection	60 dB minimum
3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-40°C to +70°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-50°C to +90°C
3.8.3	Humidity	95 percent
3.8.4	Altitude	Unlimited
3.8.5	Shock	1/2 sine at 50 g for 11 ms
3.8.6	Acceleration	100 g
3.8.7	Vibration	20 g sine, 20 to 2,000 Hz
3.8.8	Acoustics	Not measured
3.8.9	Pressurization	Not required
3.8.10	Operating Life	>1,300 hours
3.8.11	Shelf Life	5 years

3.9 PHYSICAL CHARACTERISTICS

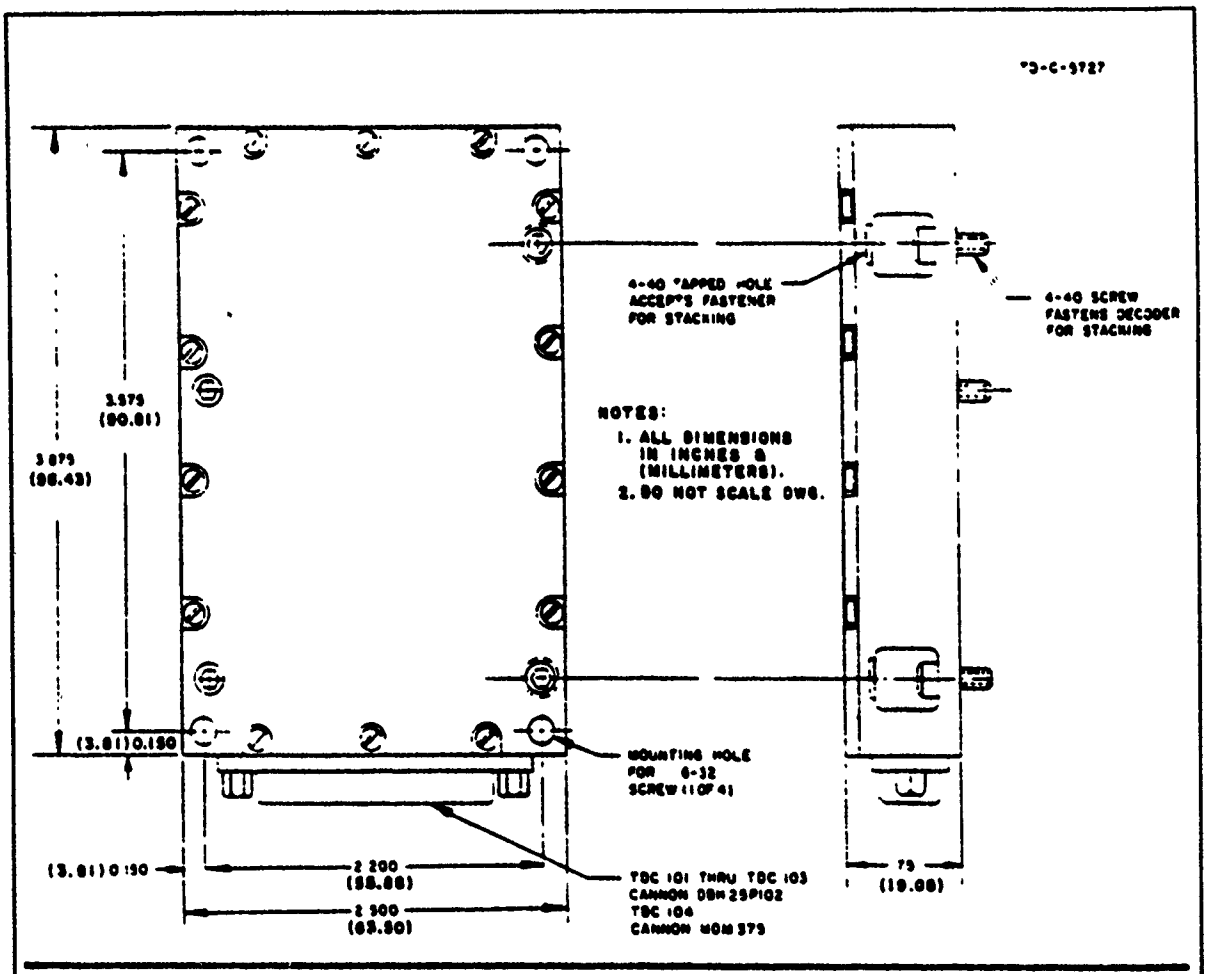
3.9.1	Volume	RCC-200: 20.1-in^3 TDC-100: 7.3-in^3
3.9.2	Dimensions	See Outline Drawing (units stackable)
3.9.3	Weight	RCC-200: 26.0 ounces maximum TDC-100: 7.5 ounces maximum
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	RCC-200 - Power and output: Bendix JTIH-8-6P RF input: TNC receptacle TDC-100 - 1- to 3-channel: Cannon DBH25P102 4-channel: Cannon MDM37S



POWER AND OUTPUT CONNECTOR
PIN CONNECTIONS

PIN NO.	FUNCTION
1	+28V
2	Power Return
3	Case Ground
4	Audio Out
5	Signal Return
6	Signal Strength Monitor

Figure 2-11. Outline drawing and pin connections of Aydin Vector Division Model RCC-200 Command and Control Receiver.



Channel No.	Center Frequency (Hz)	Channel No.	Center Frequency (Hz)
1	7,500	11	25,010
2	8,460	12	28,210
3	9,540	13	31,830
4	10,760	14	35,900
5	12,140	15	40,490
6	13,700	16	45,680
7	15,450	17	51,320
8	17,430	18	53,120
9	19,660	19	65,560
10	22,170	20	73,950

Figure 2-12. Outline drawing and channel frequencies of Aydin Vector Division TDC-100 Series Tone Decoders.

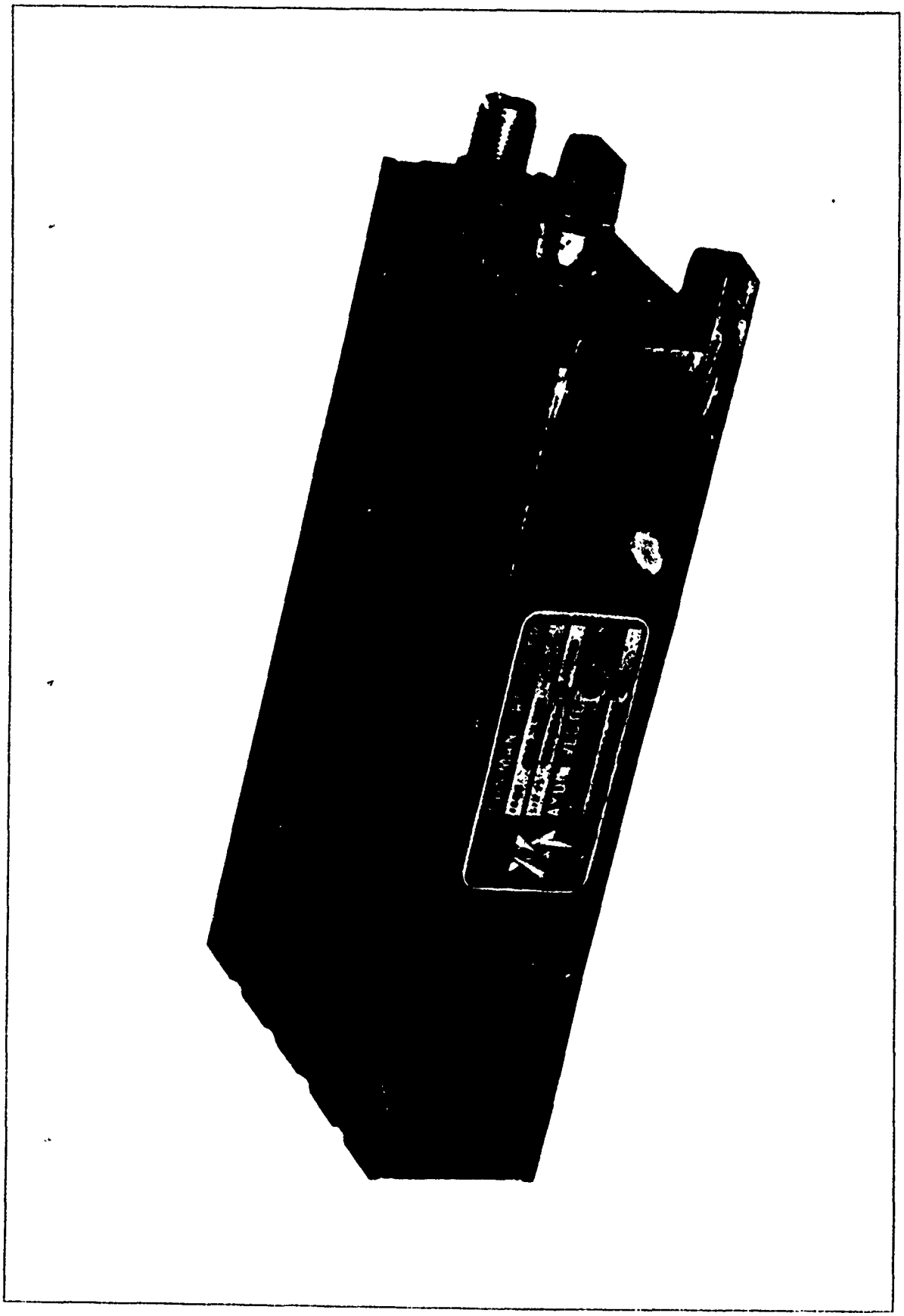


Figure 2-13. Aydin Vector Division Model RCC-204-5 Command and Control Receiver.

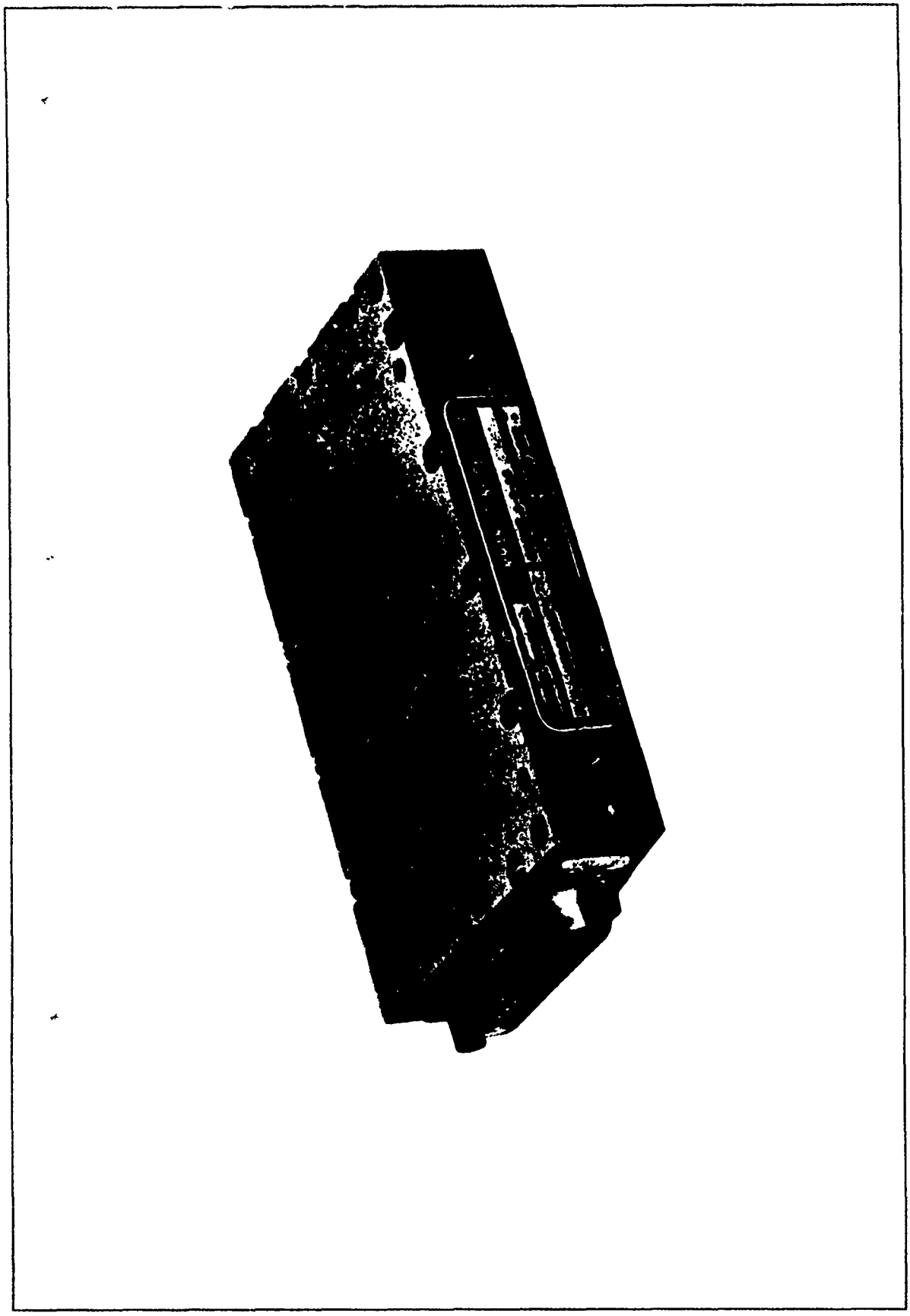


Figure 2-14. Aydin Vector Division Model TDC-103 Tone Decoder.

AYDIN VECTOR DIVISION

COMMAND AND CONTROL RECEIVER

MODEL RCC-500

1. GENERAL DESCRIPTION

The Vector Model RCC-500 Command and Control Receiver incorporates identical circuitry used in the VFTR line of receivers that was repackaged to comply with minimal space and weight.

The RCC-500 was specifically designed to the stringent electrical, environmental, and reliability of missile flight termination usage while providing the option of a variety of configurations determent by addition of external units. The receiver can recover data when driving an SBS-294 bit synchronizer or be used for command control when integrated with an external tone decoder TDC-100 series. The receiver (with the external decoder) will meet the requirements of Range Commanders Council (RCC) Document 313-89. An ultrahigh Q preselector and high IF allow the use of a single-heterodyne receiver front end, which provides more cost effective and reliable than other approaches. The receiver front end has sufficient dynamic range to meet the susceptability requirements of RCC Document 313-89 and MIL-STD-461/462.

Subassemblies are rigidly mounted in 9-in^3 housing which provides a mechanical support as well as an internal shielding for electromagnetic interference and ease of assembly. Parts were selected for maximum reliability and minimum stress. Hermetic parts are used exclusively. Vector-manufactured hybrids screened to MIL-STD-883 and other MIL-STD parts are used throughout. A variety of configurations are available to suit all environmental and budget constraints.

2. BACKGROUND

The RCC-500 was developed in response to a requirement from the SABIR Program for a small lightweight and high reliability receiver to work together with the SBS-294 bit synchronizer and recover data and clock for a highly secured guidance processor.

Vector has recently delivered Space Quality RCC-500 receivers to Swedish Space Corporation to be utilized on-board FREJA SCIENTIFIC SATELLITE.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	400 to 550 MHz
3.1.2	Threshold Sensitivity (Command Output)	1 μV with tone decoder 1 μV for S/N = 20 dB, 5 kHz Baseband Bandwidth
3.1.3	Maximum Useable RF Input	2 Vrms (Command Destruct Config.)
3.1.4	Operating Bandwidth	±45 kHz minimum (Command Destruct Config.)
3.1.5	Antenna Impedance	50 ohms
3.1.6	VSWR	2:1 maximum
3.1.7	Local Oscillator Stability	0.003 percent
3.1.8	Tuning Accuracy	0.005 percent
3.1.9	Tuning Method	Crystal-controlled local oscillator

3.2 IF SECTION

3.2.1	IF Frequency	21.4 MHz
3.2.2	Selectivity, 60 dB	±180 kHz maximum; other available
3.2.3	Capture Ratio	1 dB maximum

3.3 AUDIO SECTION

3.3.1	Audio Amplifier Response	3 dB, 300 Hz to 100 kHz
3.3.2	Audio Amplifier Distortion	≤5 percent
3.3.3	Audio Output Sensitivity	0.1 Vp-p per kHz, other sensitivities available
3.3.4	Audio Output Impedance	75 ohms; other impedances available

3.4	OUTPUT	
3.4.1	Type of Output	Audio AC coupled
3.4.2	Telemetry Outputs	Signal Strength Indication
3.5	POWER SUPPLY	
3.5.1	Supply Voltage	22 to 36 Vdc
3.5.2	Power Requirements	150 mA maximum
3.5.3	Over Voltage	±40 Vdc
3.5.4	Optional Output	15 V output to operate SBS-294 or TDC-100 Tone Decoder
3.6	ELECTROMAGNETIC INTERFERENCE	Designed to meet MIL-STD-461/462 requirements.
3.7	ENVIRONMENTAL CHARACTERISTICS	
3.7.1	Operating Temperature Range (Continuous)	-40°C to +77°C (-55°C to +85°C optional)
3.7.2	Nondestructive Temperatures (Shelf Storage)	-55°C to +110°C
3.7.3	Humidity	95 percent
3.7.4	Altitude	Unlimited
3.7.5	Shock	1,500 g SRS
3.7.6	Acceleration	150 g
3.7.7	Vibration	21 g sine, 20 to 2,000 Hz
3.7.8	Acoustics	Not measured
3.7.9	Pressurization	Not required

3.7.10	Operating Life	Up to 27,000 hours, based on parts configuration
3.7.11	Shelf Life	8 years
3.8	PHYSICAL CHARACTERISTICS	
3.8.1	Volume	9-in^3
3.8.2	Dimensions	See Outline Drawing
3.8.3	Weight	10 ounces maximum
3.8.4	Mounting Attitude	Any
3.8.5	External Adjustments	None
3.8.6	Connector Types	J1: Antenna - OSM J2: Power & Output - MDM-9S

TABLE 2-2

PIN CONNECTION OPTIONS FOR RCC-500

CONNECTOR	PIN	FUNCTION
J1	- - -	RF IN
J2	1	Audio Out
	2	N/C
	3	N/C
	4	N/C
	5	Chassis Grd.
	6	+28 Vdc IN
	7	N/C
	8	Signal Strength OUT
	9	Audio Return Chassis

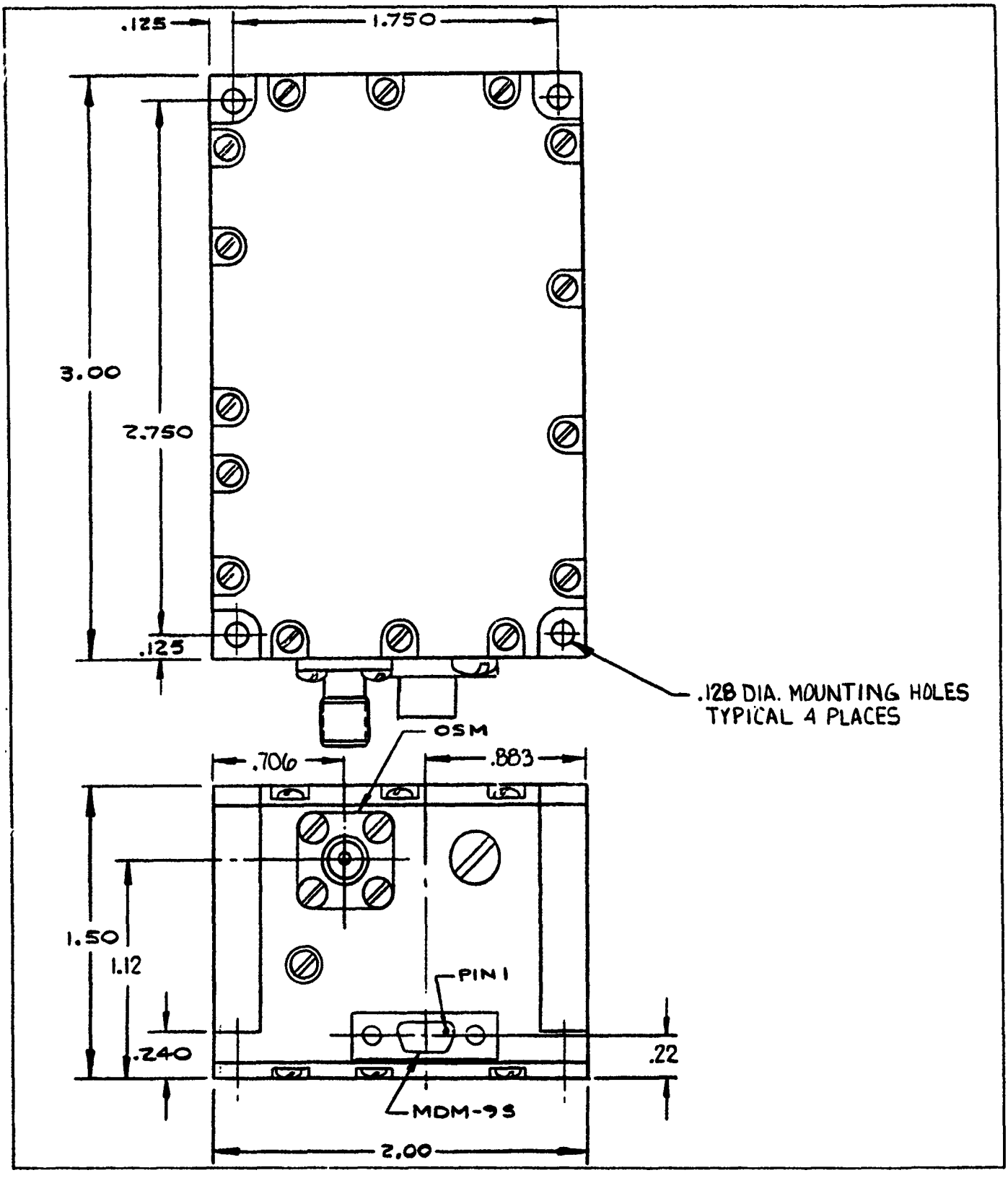


Figure 2-15. Outline drawing of Aydin Vector Division Model RCC-500 Command and Control Receiver.

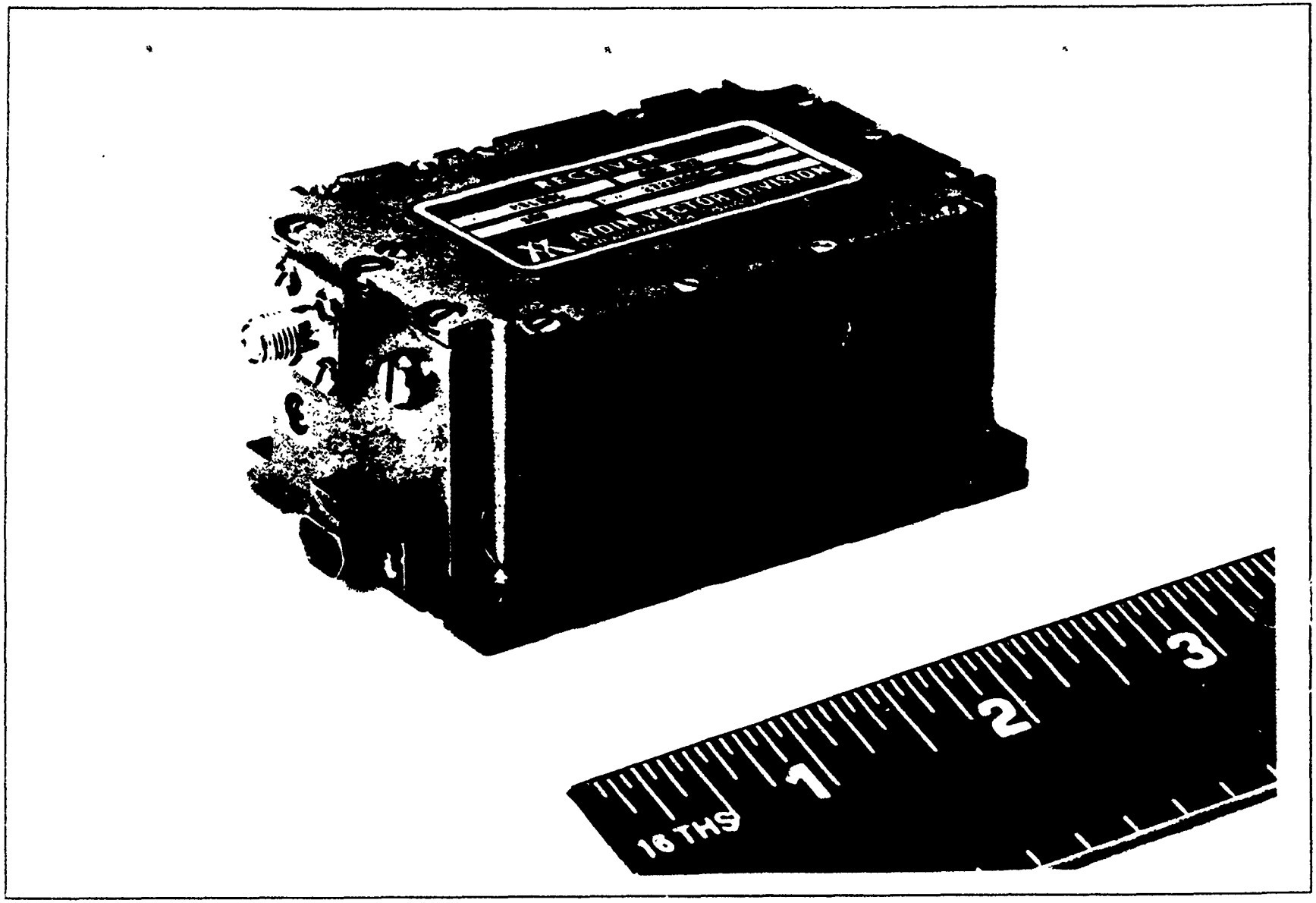


Figure 2-16. Aydin Vector Division Model RCC-500 Command and Control Receiver.

3. CINCINNATI ELECTRONICS CORPORATION
7400 Innovation Way
Mason, Ohio 45040-9699
(Phone: 513-571-6100)

COMMAND RECEIVERS/DECODERS

Model CR-104B and CR-104C

Model CR-105

Model CR-110

Model CR-112

Model CR-116

Model CR-119

Model CRD-111/202

Model CRD-117/203

Model CRD-118/204

Model CRD-120/205

CINCINNATI ELECTRONICS CORPORATION

COMMAND RECEIVER/DECODER

MODELS CR-104B AND CR-104C

1. GENERAL DESCRIPTION

The Cincinnati Model CR-104B and CR-104C Command Receivers/Decoders employ a double-conversion superheterodyne design with a single crystal oscillator. Signal strength telemetry is obtained from the second IF automatic gain control (AGC) circuit and provides an 80 dB usable range that starts at 1 μV and has a near-logarithmic curve from 0 to 4 Vdc.

The decoder design uses passive noise-immune filters as the tone detectors. Channel logic and redundancy are combined to provide immunity to inadvertent command outputs under environmental extremes and/or in the event of a single component failure (fail-safe). A test connector is provided on the top cover to permit validation of the redundant circuitry. Command output signals are provided through high-current transistor switches rated at 50 A and 28 V. The "C" version provides a delayed "Destruct" output in addition to the other command outputs.

The receiver case design provides a moisture and radio-frequency interference (RFI) seal, and the mounting surface is provided with four through holes to accommodate 1/4-inch bolts.

2. BACKGROUND

The Model CR-104 Command Receiver/Decoder and successive versions "A", "B" and "C" were designed, developed, and qualified for flight use under contract with the USAF Space Division. These units are the range safety flight termination receivers/decoders used on the THOR, ATLAS, and CENTAUR space launch vehicles. The original receiver design was accomplished in 1970, and the "B" and "C" versions are presently (1983) in manufacture.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	400 to 550 megahertz (MHz)
3.1.2	Threshold Sensitivity (Command Output)	0.7 μV (-110 dBm)
3.1.3	Maximum Useable RF Input	7 Vrms
3.1.4	Operating Bandwidth	±45 kHz

3.1.5	Antenna Impedance	50 ohms
3.1.6	VSWR	1.5:1
3.1.7	Local Oscillator Stability	0.0025 percent
3.1.8	Tuning Accuracy	0.005 percent
3.1.9	Tuning Method	Continuous (crystal-controlled)
3.2	IF SECTION	
3.2.1	IF Frequency	71 to 100 MHz and 10.7 MHz
3.2.2	Selectivity, 60 dB	360 kHz maximum
3.2.3	Capture Ratio	>0.8
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	1 dB, 1 to 35 kHz
3.3.2	Audio Amplifier Distortion	<3 percent
3.3.3	Audio Output	None
3.3.4	Frequency Deviation	±30 kHz peak per tone
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	3 (IRIG channels 1, 2, and 5)
3.4.2	Number of Simultaneous Useable Tones	3
3.4.3	Tone Channel Bandwidth	±1 percent minimum at 2 dB
3.4.4	Adjacent Channel Rejection	±4 percent maximum at 20 dB
3.4.5	Decoder Threshold Deviation	±4 kHz peak per tone

3.5	OUTPUT	
3.5.1	Types of Output	Transistor switches
3.5.2	Output Current Capability	50 A, tested at 20 A and 10 A
3.5.3	Output Leakage	0.2 mA maximum
3.5.4	Logic Circuitry	1-2-5 = Destruct 1-2-5 = Arm 1-2-5 = Optional Command
3.5.5	Response Time for Commands	20 ms maximum (13.5 ms typical)
3.5.6	Transition Time Between Commands	3 ms
3.5.7	Output Isolation	Common ground (case)
3.5.8	Noise Immunity	Noise-immune filters
3.5.9	Telemetry Outputs	Channel 5 monitor RF signal level
3.6	POWER SUPPLY	
3.6.1	Supply Voltage	22 to 35 Vdc
3.6.2	Power Requirements	Standby: <1.5 W (nominal supply) Interrogate: <5.0 W (nominal supply)
3.6.3	Power Supply Isolation	No (case common ground)
3.6.4	Turn-On Power Control for Receiver	None
3.6.5	Other Controls	None

3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461A
3.7.2	Pulse Rejection	Not measured
3.7.3	AM Rejection	100 percent, 7 μV or more
3.7.4	Image Rejection	60 dB minimum
3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-40°C to +85°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-65°C to +100°C
3.8.3	Humidity	100 percent
3.8.4	Altitude	Unlimited
3.8.5	Shock	500 g, 0.4 ms
3.8.6	Acceleration	20 g
3.8.7	Vibration	50 g (50 to 100 Hz) sine 28.8 g rms random
3.8.8	Acoustics	Not tested
3.8.9	Pressurization	Not required
3.8.10	Operating Life	500 hours
3.8.11	Shelf Life	5 years minimum
3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	138-in^3
3.9.2	Dimensions	6.0 x 5.1 x 4.5-in overall

3.9.3	Weight	4.2 pounds
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	Antenna: TNC Power: MS3112E12-10S Output: MS3112E12-10P

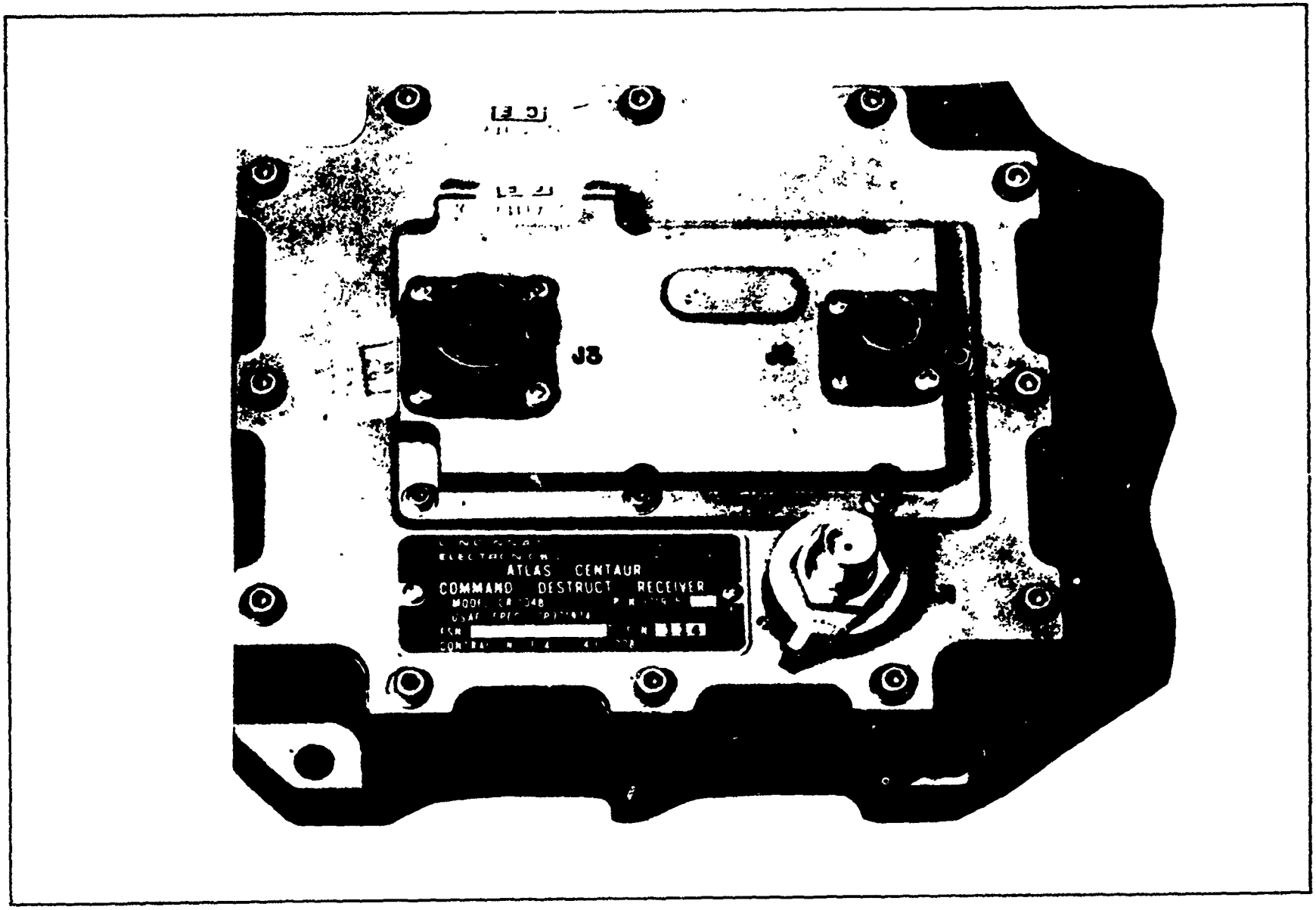


Figure 3-1. Cincinnati Electronics Corporation Model CR-104B Command Receiver.

CINCINNATI ELECTRONICS CORPORATION

COMMAND RECEIVER/DECODER

MODEL CR-105

1. GENERAL DESCRIPTION

The Cincinnati Model CR-105 Command Receiver/Decoder employ a double-conversion superheterodyne design with a single crystal oscillator. Signal strength telemetry is obtained from the second IF AGC circuit and provides an 80 dB usable range that starts at 0.5-V floor and has a near-logarithmic curve to 4 Vdc. The useful signal strength telemetry range may be externally adjusted from 1 μV to 10,000 μV.

The decoder design uses passive noise-immune filters as the tone detectors. Standard four-channel range safety logic is implemented with sufficient redundant circuits to assure fail-safe operation. Command output signals are provided through 2-A rated relay closures.

The case is sealed against moisture and RFI and mounts by means of number 10 screws through four vibration isolators in the base.

2. BACKGROUND

The Model CR-105 Command Receiver/Decoder was designed, developed, and qualified for flight use for range safety application on NASA's Delta Launch Vehicle under contract with the McDonnell Douglas Corporation. The design was accomplished in 1972/1973. Qualification tests were performed by Cincinnati Electronics Corporation in March 1973 under McDonnell Douglas Purchase Order MDAC-W-72-1-020, NASA Prime Contract NAS-7-811, reference Report No. 80045 DRW 54/373.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	400 to 550 MHz
3.1.2	Threshold Sensitivity (Command Output)	0.5 μV
3.1.3	Maximum Useable RF Input	7 Vrms
3.1.4	Operating Bandwidth	±45 kHz minimum
3.1.5	Antenna Impedance	50 ohms

3.1.6	VSWR	1.5:1
3.1.7	Local Oscillator Stability	0.0025 percent
3.1.8	Tuning Accuracy	0.005 percent
3.1.9	Tuning Method	Continuous (crystal-controlled)
3.2	IF SECTION	
3.2.1	IF Frequency	71 to 100 MHz and 10.7 MHz
3.2.2	Selectivity, 60 dB	360 kHz maximum
3.2.3	Capture Ratio	>0.8
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	1 dB, 1 to 35 kHz
3.3.2	Audio Amplifier Distortion	<3 percent
3.3.3	Audio Output	None
3.3.4	Frequency Deviation	±30 kHz peak per tone
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	4 (IRIG channels 1, 2, 4, and 5)
3.4.2	Number of Simultaneous Useable Tones	4
3.4 3	Tone Channel Bandwidth	±1 percent minimum at 2 dB
3.4.4	Adjacent Channel Rejection	±4 percent maximum at 20 dB
3.4.5	Decoder Threshold Deviation	±4 kHz peak per tone

3.5	OUTPUT	
3.5.1	Types of Output	DPDT Relay
3.5.2	Output Current Capability	20 A
3.5.3	Output Leakage	32 x 10^{-9} A maximum
3.5.4	Logic Circuitry	1-2-5 = Destruct 1-2-5 = Arm 1-2-5 = Optional command 4 = Monitor
3.5.5	Response Time for Commands	15 ms maximum
3.5.6	Transition Time Between Commands	3 ms
3.5.7	Output Isolation	Common ground (case)
3.5.8	Noise Immunity	Noise-immune filters
3.5.9	Telemetry Outputs	RF signal level Destruct event Channel 4 monitor
3.6	POWER SUPPLY	
3.6.1	Supply Voltage	24 to 32 Vdc (60 V maximum)
3.6.2	Power Requirements	Standby: <1.5 W (nominal supply) Interrogate: <6.0 W (nominal supply)
3.6.3	Power Supply Isolation	No (case common ground)
3.6.4	Turn-On Power Control for Receiver	None
3.6.5	Other Controls	None

3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461A
3.7.2	Pulse Rejection	Not measured
3.7.3	AM Rejection	100 percent, 7 μV or more
3.7.4	Image Rejection	60 dB minimum
3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-40°C to +72°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-65°C to +100°C
3.8.3	Humidity	100 percent
3.8.4	Altitude	Unlimited
3.8.5	Shock	100 g-peak (0.1 to 4.0 kHz)
3.8.6	Acceleration	20 g
3.8.7	Vibration	55 g rms random
3.8.8	Acoustics	Not tested
3.8.9	Pressurization	Not required
3.8.10	Operating Life	300 hours
3.8.11	Shelf Life	5 years minimum
3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	63-in^3 (less mounting feet)
3.9.2	Dimensions	6.0 x 3.5 x 3.0-in overall

3.9.3	Weight	3.75 pounds
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	Access to TLM adjust
3.9.6	Connector Types	Antenna: TNC Others: Deutsch DBA-50

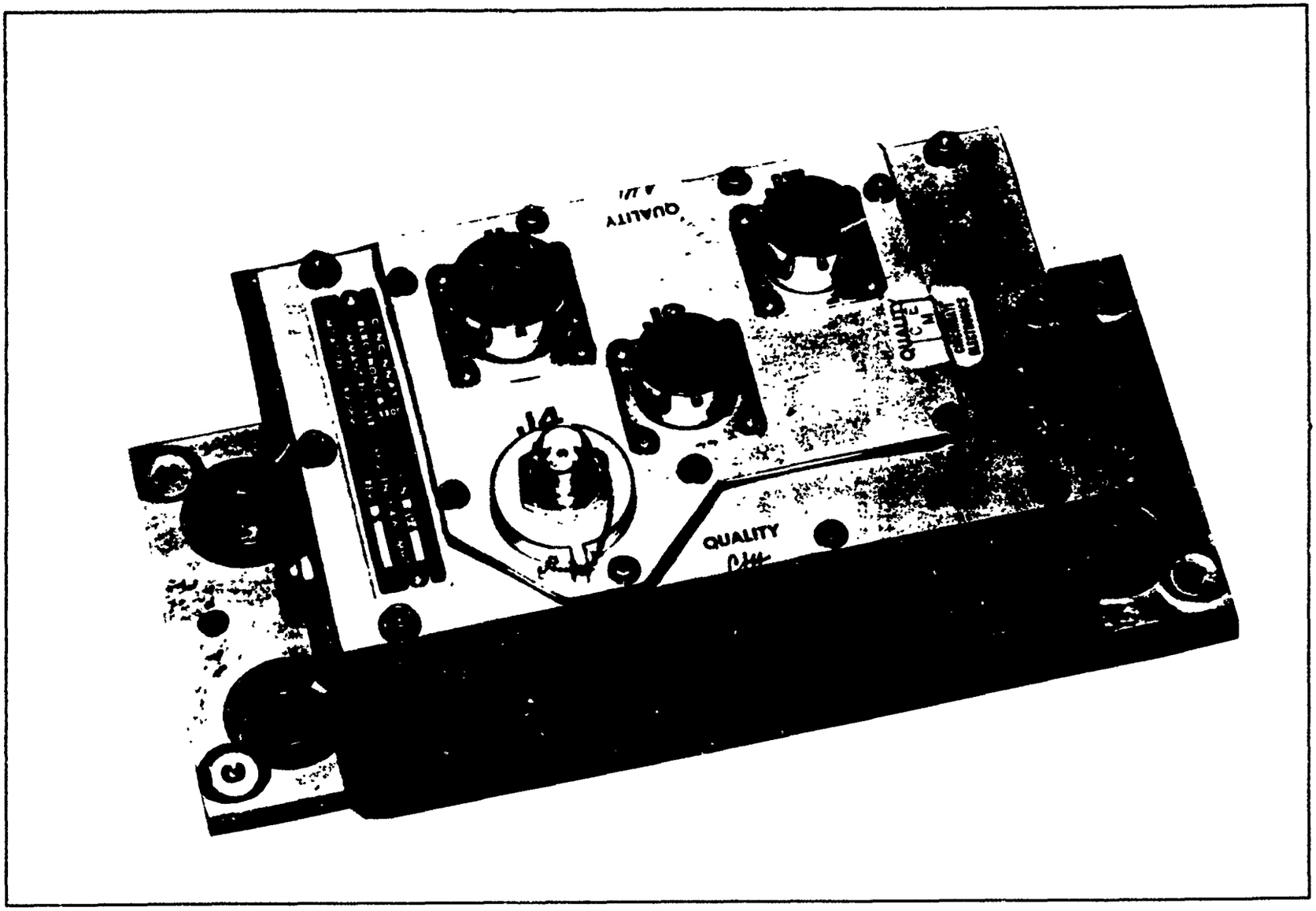


Figure 3-2. Cincinnati Electronics Corporation Model CR-105 Command Receiver.

CINCINNATI ELECTRONICS CORPORATION

COMMAND RECEIVER/DECODER

MODEL CR-110

1. GENERAL DESCRIPTION

The Cincinnati Model CR-110 Command Receiver/Decoder employs a double-conversion superheterodyne design with a single crystal-controlled transistor quadrupler circuit that provides excellent spurious response performance. Typical receiver sensitivity is less that 1 μV.

The decoder design uses phase-lock-loop integrated circuit tone detectors. These provide ±1 percent bandwidth selectivity and exhibit a narrow skirt ratio that provides protection against outputs due to noise.

In the four-channel configuration, the unit has a 16-in^3 volume and weighs less than 1 pound. Four 0.174-in (nominal) radius holes are provided for mounting.

2. BACKGROUND

The Model CR-110 Command Receiver/Decoder was designed and developed on a Cincinnati Electronics Corporation internally funded program in 1975. Variations of this design have resulted in the evolution of a whole family of CR-110 receivers/decoders. Versions of the CR-110 can accommodate any number of standard IRIG tone channels, various logic configurations, relay or solid-state outputs, and several different connector configurations.

Qualification tests were conducted by White Sands Missile Range (WSMR) during the periods of May 1978 through August 1978 and December 1978 through March 1979.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	400 to 550 MHz
3.1.2	Threshold Sensitivity (Command Output)	1 μV
3.1.3	Maximum Useable RF Input	1 Vrms
3.1.4	Operating Bandwidth	±45 kHz minimum

3.1.5	Antenna Impedance	50 ohms
3.1.6	VSWR	1.5:1
3.1.7	Local Oscillator Stability	0.0025 percent
3.1.8	Tuning Accuracy	0.005 percent
3.1.9	Tuning Method	Continuous (crystal-controlled)
3.2	IF SECTION	
3.2.1	IF Frequency	21.4 MHz
3.2.2	Selectivity, 60 dB	360 kHz maximum
3.2.3	Capture Ratio	>0.8
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	3 dB, 5 to 100 kHz
3.3.2	Audio Amplifier Distortion	<5 percent
3.3.3	Audio Output	Optional
3.3.4	Frequency Deviation	±30 kHz peak per tone
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	Optional (up to 10 IRIG channels available)
3.4.2	Number of Simultaneous Useable Tones	4
3.4.3	Tone Channel Bandwidth	±1 percent minimum
3.4.4	Adjacent Channel Rejection	±3.5 percent maximum
3.4.5	Decoder Threshold Deviation	±4 kHz peak per tone

3.5	OUTPUT	
3.5.1	Types of Output	Optional (DPDT relay or transistor switch)
3.5.2	Output Current Capability	20 A (relay output)
3.5.3	Output Leakage	35 x 10^{-9} A maximum (relay output)
3.5.4	Logic Circuitry	Various
3.5.5	Response Time for Commands	25 ms maximum
3.5.6	Transition Time Between Commands	3 ms
3.5.7	Output Isolation	Common ground (case)
3.5.8	Noise Immunity	Yes - no lockup with receiver noise
3.5.9	Telemetry Outputs	RF signal level
3.6	POWER SUPPLY	
3.6.1	Supply Voltage	22 to 35 Vdc
3.6.2	Power Requirements	Standby: 180 mA Interrogate: 25 mA additional per channel
3.6.3	Power Supply Isolation	No (case common ground)
3.6.4	Turn-On Power Control for Receiver	Latching relay for ON-OFF control is available
3.6.5	Other Controls	None
3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461A
3.7.2	Pulse Rejection	Not measured
3.7.3	AM Rejection	50 percent, 7 µV or more
3.7.4	Image Rejection	60 dB minimum

3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-40°C to +75°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-60°C to +100°C
3.8.3	Humidity	90 percent
3.8.4	Altitude	Unlimited
3.8.5	Shock	100 g
3.8.6	Acceleration	100 g
3.8.7	Vibration	25.0 g (10 to 3,000 Hz) 29.4 g rms random
3.8.8	Acoustics	Not tested
3.8.9	Pressurization	Not required
3.8.10	Operating Life	200 hours
3.8.11	Shelf Life	3 years minimum
3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	16-in^3 (4-channel version)
3.9.2	Dimensions	4.39 x 2.50 x 1.50-in (4-channel version)
3.9.3	Weight	<1 pound (4-channel version)
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	Antenna: SMA type Others: M24308/3-2 (various other connector configurations available)

Figure 3-3. Various configurations of the Cincinnati Electronics Corporation Model CR-110 family of command receivers.

CINCINNATI ELECTRONICS CORPORATION

COMMAND RECEIVER/DECODER

MODEL CR-112

1. GENERAL DESCRIPTION

The Cincinnati Model CR-112 Command Receiver/Decoder employs a single-conversion superheterodyne design and a crystal-controlled local oscillator design that provides excellent spurious response performance. Typical receiver sensitivity is less than 1 μV.

The decoder design uses passive, inductive-capacitive (LC), noise-immune filters as the tone detectors. Standard four-channel range safety logic is implemented with sufficient redundant circuits to assure fail-safe operation. Command output signals are provided from discrete differential line-driver circuits.

The unit is packaged in an aluminum cast housing. The mounting surface contains four tapped holes to accommodate number 10-32 mounting bolts.

2. BACKGROUND

The Model CR-112 Command Receiver/Decoder was designed, developed, and qualified for flight use for range safety application for the Peacekeeper (MX) Missile. The design was accomplished in 1980/1981 under Martin Marietta Corporation for USAF/BMO. Qualification tests were performed by Cincinnati Electronics Corporation during the period of January 1982 through November 1982.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	400 to 550 MHz
3.1.2	Threshold Sensitivity (Command Output)	<1.5 μV
3.1.3	Maximum Useable RF Input	5 Vrms
3.1.4	Operating Bandwidth	±45 kHz minimum
3.1.5	Antenna Impedance	50 ohms
3.1.6	VSWR	1.5:1

3.1.7	Local Oscillator Stability	0.0025 percent
3.1.8	Tuning Accuracy	0.005 percent
3.1.9	Tuning Method	Continuous (crystal-controlled)
3.2	IF SECTION	
3.2.1	IF Frequency	21.4 MHz
3.2.2	Selectivity, 60 dB	360 kHz maximum
3.2.3	Capture Ratio	>0.8
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	1 dB, 1 to 35 kHz
3.3.2	Audio Amplifier Distortion	<3 percent
3.3.3	Audio Output	None
3.3.4	Frequency Deviation	±30 kHz peak per tone
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	4 (IRIG channels 1, 2, 4, and 5)
3.4.2	Number of Simultaneous Useable Tones	4
3.4.3	Tone Channel Bandwidth	±1 percent minimum
3.4.4	Adjacent Channel Rejection	±4 percent maximum
3.4.5	Decoder Threshold Deviation	±4 kHz peak per tone
3.5	TPUT	
3.5.1	Types of Output	Discrete differential line drivers
3.5.2	Output Current Capability	40 mA at within 2 V of B+ for destruct; other outputs at logic levels

3.5.3	Output Leakage	Differential line driver output
3.5.4	Logic Circuitry	1-2-5 = Destruct 1-2-5 = Arm 1-2-5 = Optional Command
3.5.5	Response Time for Commands	15 ms
3.5.6	Transition Time Between Commands	3 ms
3.5.7	Output Isolation	Yes
3.5.8	Noise Immunity	Noise-immune filters
3.5.9	Telemetry Outputs	RF signal level Channel 4 monitor
3.6	POWER SUPPLY	
3.6.1	Supply Voltage	28 ±4 Vdc
3.6.2	Power Requirements	Standby: 150 mA Interrogate: 320 mA
3.6.3	Power Supply Isolation	DC-to-dc converter power supply design
3.6.4	Turn-On Power Control for Receiver	None
3.6.5	Other Controls	None
3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461A
3.7.2	Pulse Rejection	Not tested
3.7.3	AM Rejection	50 percent, 12 μV
3.7.4	Image Rejection	60 dB minimum

3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-0°C to +61°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-53°C to +67°C
3.8.3	Humidity	90 percent
3.8.4	Altitude	Unlimited
3.8.5	Shock	7,000 g pyro
3.8.6	Acceleration	13 g
3.8.7	Vibration	8.8 g rms random
3.8.8	Acoustics	Not tested
3.8.9	Pressurization	Not required
3.8.10	Operating Life	1,000 hours minimum
3.8.11	Shelf Life	5 years minimum
3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	74-in^3 (plus connectors)
3.9.2	Dimensions	6.0 x 4.1 x 3.0-in (plus connectors)
3.9.3	Weight	<3.75 pounds
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	Antenna: TNC Others: D38999/42FB35PN D38999/42FC35PN

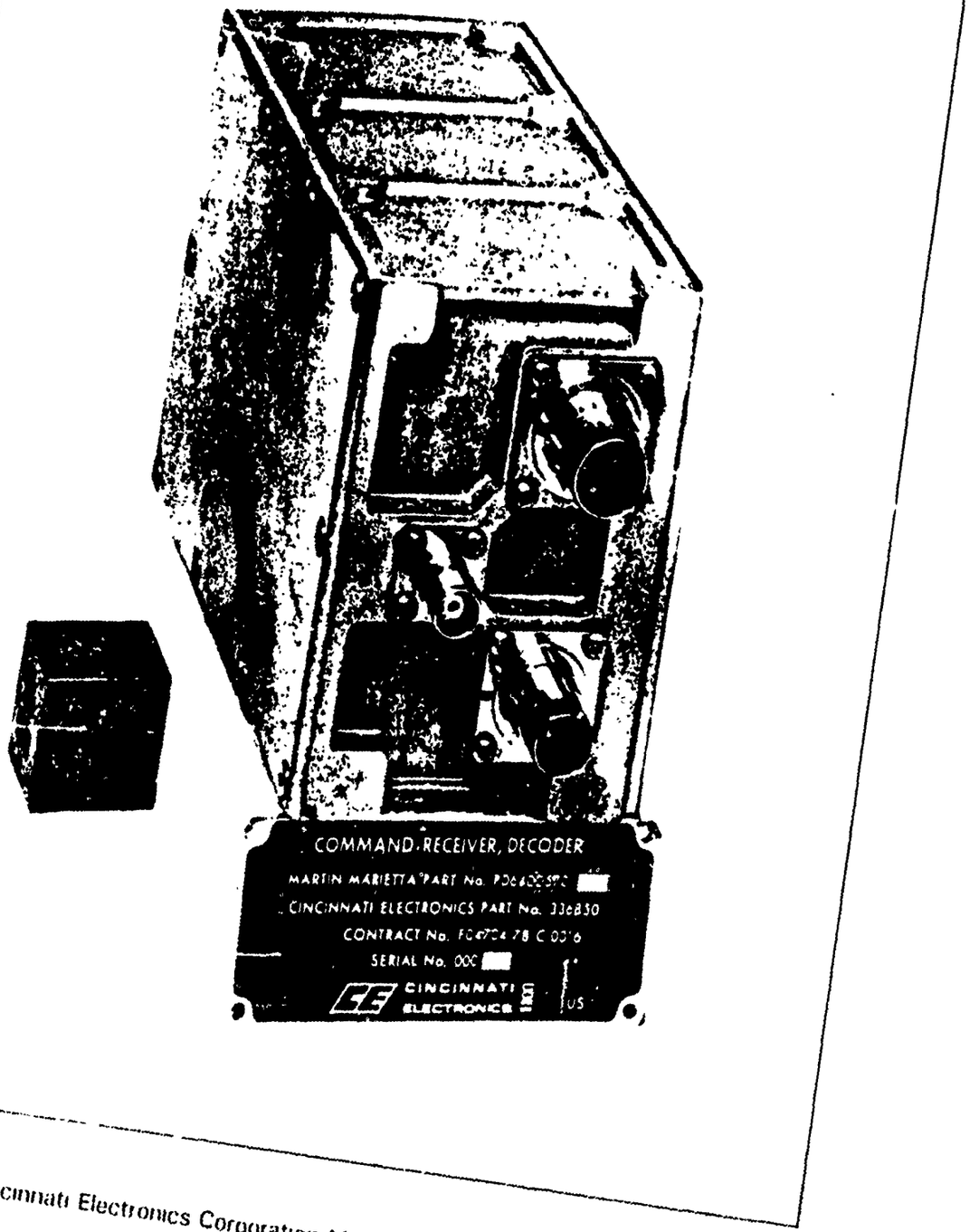


Figure 3-4. Cincinnati Electronics Corporation Model CR 112 Command Receiver/Decoder.

CINCINNATI ELECTRONICS CORPORATION

COMMAND RECEIVER/DECODER

MODEL CR-116

1. GENERAL DESCRIPTION

The Cincinnati Model CR-116 Command Receiver/Decoder is a single-conversion superheterodyne design. The RF preselector is implemented using Surface Acoustic Wave (SAW) devices, and the IF is 21.4 MHz, which allow the receiver to exhibit exceptional image rejection and spurious response performance. Typical receiver sensitivity is less than 1 μV.

The IRIG audio tone detection is accomplished by a microprocessor and associated circuitry. The audio signal is digitized and processed using a Finite Impulse Response (FIR) filter algorithm. The tone detection threshold self adjusts to the signal and noise characteristics of the audio signal, thus providing excellent tone detection and decoding performance. In addition, under control of the microprocessor, the AGC voltage level and unit temperature data are processed to provide a precision telemetry output. A 0 to 5 V linear, temperature stable, signal is thereby provided as an indication of the receiver RF input signal strength to within ±1 dB.

A 50 ampere (rated) transistor switch is used to provide the high-current "Destruct" output. Other command outputs are implemented with transistor switches with 3 A capabilities.

The unit is packaged in an aluminum cast housing. The mounting surface contains four tapped holes on 6.5 x 2.0-inch centers to accommodate number 10-32 mounting screws.

2. BACKGROUND

The Model CR-116 Command Receiver/Decoder was developed and qualified for range safety application for the Minuteman III Missile. The design was accomplished in 1985/1986 under contract with USAF/OALC. Qualification tests were performed by Cincinnati Electronics Corporation during the period of December 1986 through March 1987.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	400 to 550 MHz
3.1.2	Threshold Sensitivity (Command Output)	3 μV (1 μV typical)
3.1.3	Maximum Useable RF Input	1 Vrms

3.1.4	Operating Bandwidth	±45 kHz minimum
3.1.5	Antenna Impedance	50 ohms
3.1.6	VSWR	1.25:1
3.1.7	Local Oscillator Stability	0.0025 percent
3.1.8	Tuning Accuracy	0.005 percent
3.1.9	Tuning Method	Continuous (crystal-controlled)
3.2	IF SECTION	
3.2.1	IF Frequency	21.4 MHz
3.2.2	Selectivity, 3 dB BW 60 dB BW	180 kHz (minimum) 360 kHz (maximum)
3.2.3	Capture Ratio	>0.8
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	1 dB, 5 to 15 kHz
3.3.2	Audio Amplifier Distortion	<2 percent
3.3.3	Audio Output	None
3.3.4	Frequency Deviation	±30 kHz peak per tone
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	4 (IRIG channels 1, 2, 4, and 5)
3.4.2	Number of Simultaneous Useable Tones	4
3.4.3	Tone Channel Bandwidth	±1 percent minimum at 2 dB
3.4.4	Adjacent Channel Rejection	±3.5 percent maximum at 20 dB
3.4.5	Decoder Threshold Deviation	±12 kHz peak per tone

3.5	OUTPUT	
3.5.1	Types of Output	Transistor Switch
3.5.2	Output Current Capability	
	Destruct Output	16.0 A for 10 seconds
	All Other Commands	0.5 A continuous
3.5.3	Output Leakage	1 μA (maximum)
3.5.4	Logic Circuitry (List Sequence)	In accordance with RCC 313-80
3.5.5	Response Time for Commands	15 ms (maximum)
3.5.6	Output Isolation	Outputs isolated from case
3.5.7	Noise Immunity	Yes - software programmable variable threshold
3.5.8	Telemetry Outputs	
	Power Input Voltage:	0 to 5 V linearly for 20 to 32 Vdc
	Channel 4 Command:	0 V for no command, 5 V for command
	RF Signal Strength:	0 to 5 precision telemetry
3.6	POWER SUPPLY	
3.6.1	Supply Voltage	20 to 32 Vdc
3.6.2	Power Requirements	Standby: 4.5 W (maximum) Interrogate: 6.0 W (maximum)
3.6.3	Power Supply Isolation	Yes, dc-to-dc converter
3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461A
3.7.2	AM Rejection	50 percent, 7 μV or more
3.7.3	Image Rejection	60 dB (minimum), 100 dB typical
3.7.4	Spurious Response Rejection	80 dB (minimum), 100 dB typical

3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range	+10°C to +65°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-55°C to +65°C
3.8.3	Humidity	90 percent
3.8.4	Altitude	Unlimited
3.8.5	Shock	100 g (non-operating) 30 g (operating) 2,500 g pyro (operating)
3.8.6	Acceleration	Not specified
3.8.7	Vibration (sine)	40 g-peak, 5 to 300 Hz 3.5 g rms, 300 to 2,000 Hz
3.8.8	Vibration (random)	26.4 g rms overall
3.8.9	Pressurization	Not required
3.8.10	Operating Life	500 hours
3.8.11	Shelf Life	5 years
3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	73-in^3 (plus connector protrusions)
3.9.2	Dimensions	7.6 x 3.3 x 2.9-in
3.9.3	Weight	4 pounds
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	
	J1, RF Input:	TNC
	J2, Power:	M83723/82R1415N
	J3, Destruct Output:	M83723/82R1407N

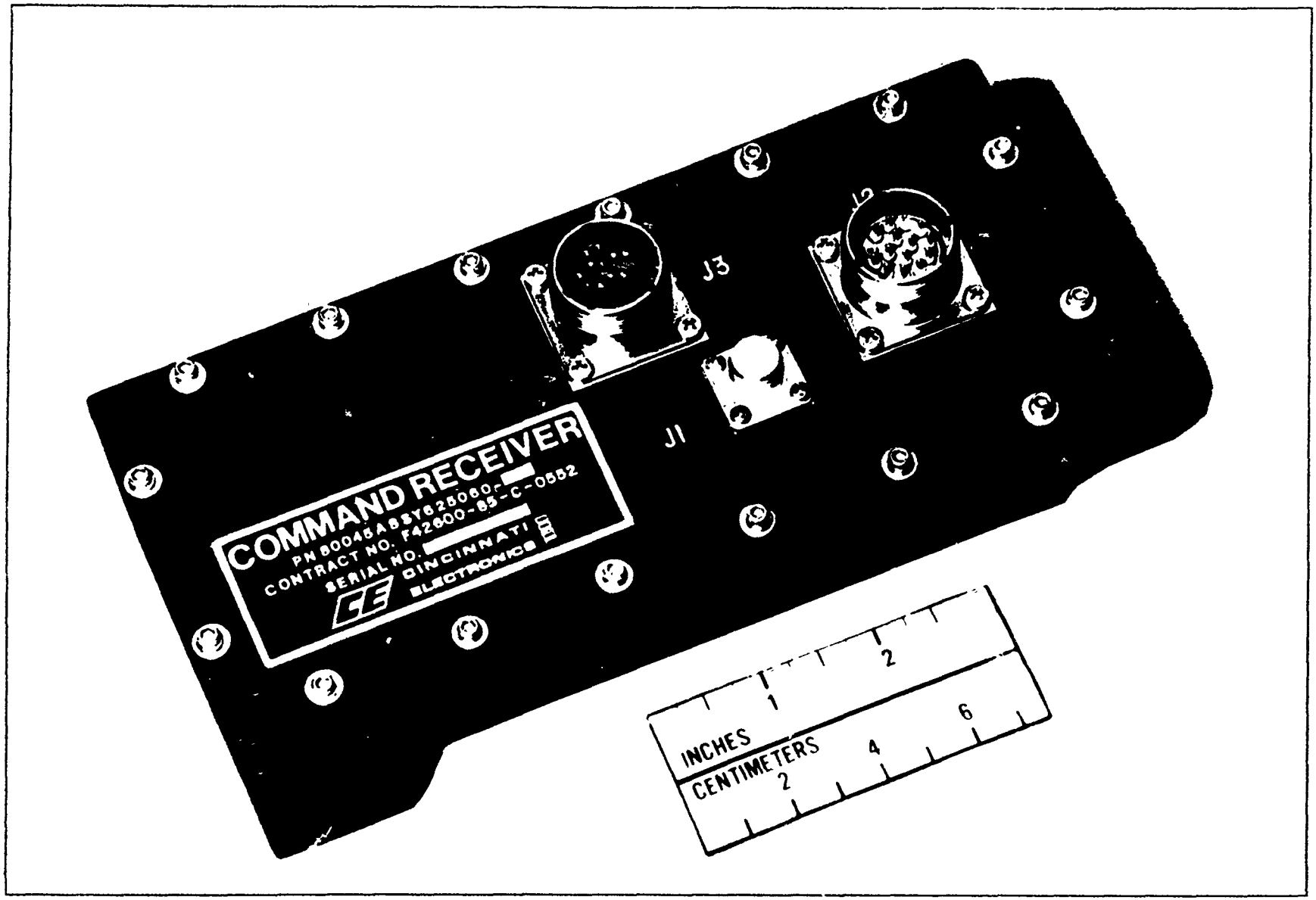


Figure 3-5. Cincinnati Electronics Corporation Model CR-116 Command Receiver Decoder.

CINCINNATI ELECTRONICS CORPORATION

COMMAND RECEIVER/DECODER

MODEL CR-119

1. GENERAL DESCRIPTION

The Cincinnati Model CR-119 Command Receiver/Decoder design reflects extensive use of surface mounted components which result in a miniature receiver with a volume of less than 5.5 cubic inches (excluding mounting feet and connector protrusions) and a weight of less than 6 ounces. It is a single-conversion superheterodyne design with a preselector of Surface Acoustic Wave (SAW) devices.

The IRIG audio tone detection is accomplished by phase-lock-loop integrated circuits. The decoder logic circuitry is compatible with the traditional range safety modulation/decoding technique (tones 1, 2, and 5). Closure of contacts, rated at 1 A continuous at 28 Vdc, are provided for each command output.

The unit, which weighs less than 6 ounces, is packaged in an aluminum housing. Two 7/32-inch through-holes are provided in the flange surface for mounting the receiver.

2. BACKGROUND

The Model CR-119 Command Receiver/Decoder was developed for range safety application for the Short Range Attack Missile II (SRAM II). The design was accomplished in 1989/1990 under contract with Boeing. Qualification tests were completed in April 1991

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	275 to 550 MHz
3.1.2	Threshold Sensitivity (Command Output)	-101 dBm (-107 dBm typical)
3.1.3	Maximum Useable RF Input	2 Vrms
3.1.4	Operating Bandwidth	±45 kHz minimum

3.1.5	Antenna Impedance	50 ohms
3.1.6	VSWR	1.5:1
3.1.7	Local Oscillator Stability	0.0025 percent
3.1.8	Tuning Accuracy	0.005 percent
3.1.9	Tuning Method	Continuous (crystal-controlled)
3.2	IF SECTION	
3.2.1	IF Frequency	21.4 MHz
3.2.2	Selectivity, 3 dB BW 60 dB BW	180 kHz (minimum) 360 kHz (maximum)
3.2.3	Capture Ratio	>0.8
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	1 dB, 5 to 15 kHz
3.3.2	Audio Amplifier Distortion	<2 percent
3.3.3	Audio Output	None
3.3.4	Frequency Deviation	±30 kHz peak per tone
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	4 (IRIG channels 1, 2, 4, and 5)
3.4.2	Number of Simultaneous Useable Tones	4
3.4.3	Tone Channel Bandwidth	±1 percent minimum at 2 dB
3.4.4	Adjacent Channel Rejection	±3.5 percent maximum at 20 dB
3.4.5	Decoder Threshold Deviation	±9 kHz peak per tone

3.5	OUTPUT	
3.5.1	Types of Output	Relay*
3.5.2	Output Current Capability (Destruct, Arm, and OC)	1 A continuous
3.5.3	Output Leakage	None
3.5.4	Logic Circuitry	In accordance with RCC 313, Opt., Arm & Destruct
3.5.5	Response Time for Commands	25 ms
3.5.6	Output Isolation	Outputs isolated from case
3.5.7	Telemetry Outputs	
	Channel 4 Command	0 V for No Command, 28 V for Command
	RF Signal Strength	0 to 5 V
	Command Outputs	Arm, Optional and Destruct Monitors
3.6	POWER SUPPLY	
3.6.1	Supply Voltage	18 to 35 Vdc
3.6.2	Power Consumption	Standby: 60 mA Interrogate: 140 mA
3.6.3	Power Supply Isolation	Yes
3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461A
3.7.2	AM Rejection	50 percent, 7 μV or more
3.7.3	Image and Spurious Rejection	60 dB minimum, 100 dB typical

3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range	-55°C to +85°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-55°C to +125°C
3.8.3	Humidity	90 percent
3.8.4	Altitude	Unlimited
3.8.5	Shock	150 g (operating)
3.8.6	Acceleration	30 g
3.8.7	Vibration	15.4 g rms random
3.8.8	Operating Life	500 hours
3.8.9	Shelf Life	15 years
3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	5.5-in^3
3.9.2	Dimensions	3.975 x 1.750 x 0.795-in
3.9.3	Weight	6 ounces
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	
	J1, Power & Output	M24308/23-2
	J2, RF Input	M39012/60-3002

*Solid-state on request

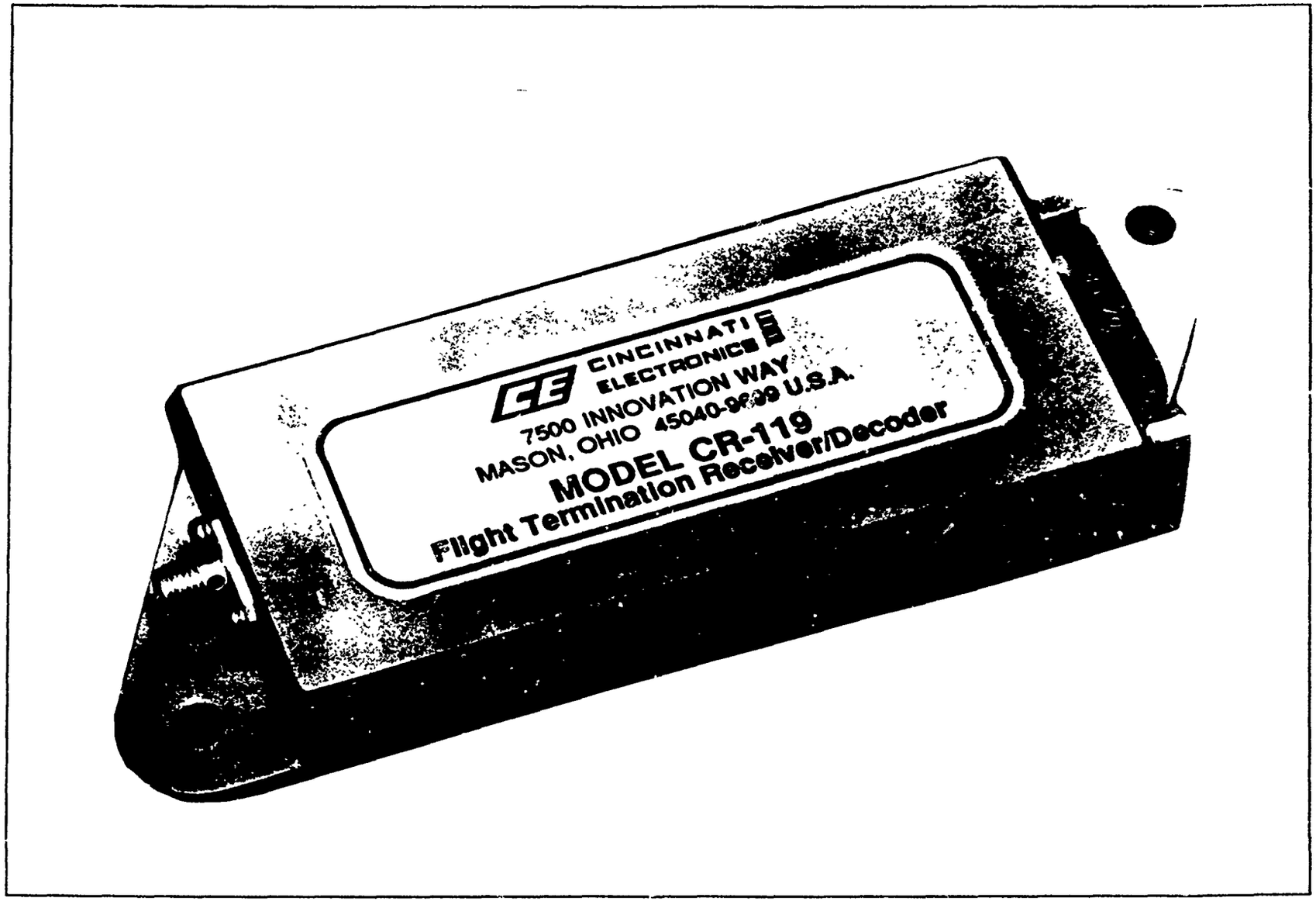


Figure 3-6. Cincinnati Electronics Corporation Model CR-119 Command Receiver/Decoder.

CINCINNATI ELECTRONICS CORPORATION

COMMAND RECEIVER/DECODER

MODEL CRD-111/202

1. GENERAL DESCRIPTION

The Cincinnati Model CRD-111/202 Command Receiver/Decoder employs a single-conversion superheterodyne design, and the decoder uses a microprocessor. Tone detection of the high-alphabet command characters is accomplished by the microprocessor using a Fast Fourier Transform algorithm that provides nearly ideal filter performance for each of the seven audio tones used in the modulation format. In addition, detection of a "Pilot Tone" is accomplished, and a telemetry indication of its presence is provided.

The message decoding process is accomplished by the microprocessor and the associated circuitry. The sequence of detected characters (a character consists of two simultaneously transmitted audio tones) is compared to the previously stored "code-of-the-mission". If the comparison if favorable, an output command is generated; if the sequence does not compare, the decoder is reset. A nonvolatile memory is contained within the unit to store the selected (2-tone) 11 character codes. The unit is field-programmed with a KYK-13 Electronic Transfer Device, and it provides automatic verification to the programming device whenever a new code is entered.

The CRD-111/202 provides for five solid-state command outputs When to proper code has been decoded, a 28 Vdc output is provided for a duration of 45 ms.

The unit is packaged in an aluminum housing. The mounting surface of the housing is provided with four through-holes in a 4-inch square pattern to accommodate 1/4-inch bolts.

2. BACKGROUND

The Model CRD-111/202 Command Receiver/Decoder was designed, developed and qualified for flight use under contract with the National Aeronautics and Space Administration Marshall Space Flight Center (NASA/MSFC). This unit is the range safety flight termination receiver/decoder used on the Space Shuttle Launch Vehicle. The design was accomplished in 1979/1980 and is compatible with the "high-alphabet" and the selectable "code-of-the-mission" range safety coding technique used for manned space flight launches. In addition, the CRD-111/202 is designed to be recovered and reused for a number of launches.

Qualification tests were performed by Cincinnati Electronics Corporation under contract with NASA/MSFC (Contract NAS8-33440). Tests were initiated in October 1981, and single mission qualification tests were completed in January 1982. Seven mission qualification tests were completed in April 1982.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	400 to 550 MHz
3.1.2	Threshold Sensitivity (Command Output)	<3 µV (1 µV typical)
3.1.3	Maximum Useable RF Input	+13 dBm
3.1.4	Operating Bandwidth	±45 kHz minimum
3.1.5	Antenna Impedance	50 ohms
3.1.6	VSWR	1.5:1
3.1.7	Local Oscillator Stability	0.0025 percent
3.1.8	Tuning Accuracy	0.005 percent
3.1.9	Tuning Method	Continuous (crystal-controlled)

3.2 IF SECTION

3.2.1	IF Frequency	10.7 MHz
3.2.2	Selectivity, 60 dB	360 kHz (minimum)
3.2.3	Capture Ratio	>0.8

3.3 AUDIO SECTION

3.3.1	Audio Amplifier Response	1.5 dB, 7 to 14 kHz
3.3.2	Audio Amplifier Distortion	<10 percent
3.3.3	Audio Output	None
3.3.4	Frequency Deviation	±30 kHz peak per tone

3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	8 (nonstandard IRIG) Tone 1 - 7.35 kHz Tone 2 - 8.40 kHz Tone 3 - 9.45 kHz Tone 4 - 10.50 kHz Tone 5 - 11.55 kHz Tone 6 - 12.60 kHz Tone 7 - 13.65 kHz Pilot Tone - 15.45 kHz
3.4.2	Number of Simultaneous Useable Tones	2 tones per character, 11 character sequence
3.4.3	Tone Channel Bandwidth	150 Hz minimum effective bandwidth
3.4.4	Adjacent Channel Rejection	±4 percent maximum at 20 dB
3.4.5	Decoder Threshold Deviation	±4 kHz peak per tone
3.5	OUTPUT	
3.5.1	Types of Output	Five command outputs through transistor switches
3.5.2	Output Current Capability	28 ±3 Vdc into 175 ohms worst case for 45 ±1 ms
3.5.3	Output Leakage	5 µV maximum
3.5.4	Logic Circuitry (List Sequence)	Microprocessor-controlled, programmable decoding, high-alphabet code modulation
3.5.5	Response Time for Commands	CLASSIFIED
3.5.6	Transition Time Between Commands	CLASSIFIED
3.5.7	Output Isolation	10^7 ohms minimum
3.5.8	Noise Immunity	Yes (uses "code-of-the-mission")
3.5.9	Telemetry Outputs	RF Signal Level Power On/Pilot Tone Present

3.6	POWER SUPPLY	
3.6.1	Supply Voltage	24 to 36 Vdc
3.6.2	Power Requirements	15 W maximum (steady-state)
3.6.3	Power Supply Isolation	DC-to-dc converter power supply
3.6.4	Turn-On Power Control for Receiver	None
3.6.5	Other Controls	None
3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets JSC-SL-E-002
3.7.2	Pulse Rejection	2 ms RF blanking pulse
3.7.3	AM Rejection	Not measured
3.7.4	Image Rejection	60 dB minimum
3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-20°F to +155°F
3.8.2	Nondestructive Temperatures (Shelf Storage)	-40°F to +165°F
3.8.3	Humidity	100 percent
3.8.4	Altitude	Unlimited
3.8.5	Shock	30 g peak, 150 ms impact 1,875 g-peak, (4,000 to 10,000 Hz)
3.8.6	Acceleration	Not tested
3.8.7	Vibration	19 g rms random
3.8.8	Acoustics	Overall SPL 152 dB, 60 s
3.8.9	Pressurization	Not required

3.8.10	Operating Life	50,000 hours MTBF calculated
3.8.11	Shelf Life	5 years minimum
3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	93-in^3 (plus connectors and mounting protrusions)
3.9.2	Dimensions	8.01 x 4.66 x 4.54-in overall
3.9.3	Weight	<5 pounds
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	Antenna: TNC Others: NBOH 10-6 PN NBOH 10-6 PW NBOH 14-15 PN NBOH 12-10 PN

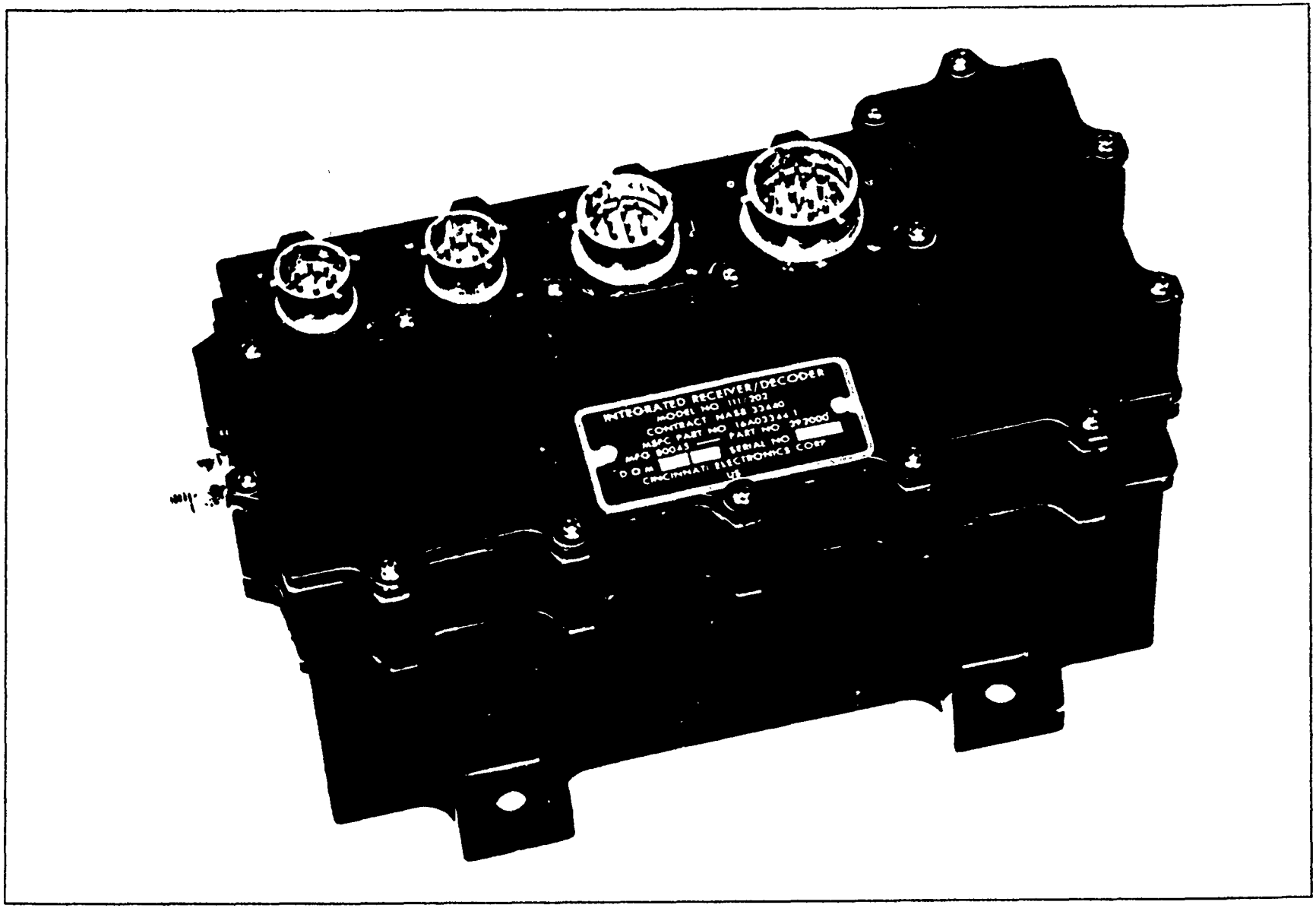


Figure 3-7. Cincinnati Electronics Corporation Model CRD-111/202 Command Receiver/Decoder.

CINCINNATI ELECTRONICS CORPORATION

COMMAND RECEIVER/DECODER

MODEL CRD-117/203

1. GENERAL DESCRIPTION

The Cincinnati Model CRD-117/203 Command Receiver/Decoder is a single-conversion superheterodyne design. The RF preselector is implemented using Surface Acoustic Wave (SAW) devices, and the IF is 21.4 MHz. These allow the receiver to exhibit exceptional image rejection and spurious response performance. Typical receiver sensitivity is less than 1 μV.

The "high-alphabet" tone frequency detection is accomplished by a microprocessor and associated circuitry. The audio signal as recovered by the receiver section is digitized and processed using a Fast Fourier Transform (FFT) algorithm. The tone detection threshold self-adjusts to the signal and noise characteristics of the audio signal. This provides excellent tone detection performance for the seven audio tones used in the modulation format. In addition, detection of a "pilot tone" is accomplished, and a telemetry indication of its presence is provided.

The message decoding is accomplished by a microprocessor and associated circuitry. The sequence of detected characters (a character consists of two simultaneously transmitted tones) is compared with the prestored code-of-the-mission. If the comparison is favorable, a command output is issued; if the sequence does not compare, no command is issued. A non-volatile memory is contained within the unit to store the selected 11 character codes. This unit is field-programmed with a KYK-13 Electronic Transfer Device, and it provides automatic verification to the programming device whenever a new code is entered.

A 28 Vdc, 54 A transistor-switched command destruct output is provided for a duration of 250 ms. Arm and OC outputs are 28 Vdc, 5 A and 28 Vdc, 0.5 A (respectively) transistor-switched, continuous.

In addition, under control of the microprocessor, the AGC voltage level and unit temperature data are processed to provide a precision telemetry output. A 0 to 5 V linear, temperature stable, signal is thereby provided as an indication of the receiver RF input signal strength to within ±1 dB.

The unit is packaged in an aluminum cast housing. The mounting surface contains six tapped holes on 6.50 x 1.75-inch centers to accommodate number 10-32 mounting screws.

2. BACKGROUND

The Model CRD-117/203 Command Receiver/Decoder was developed and qualified for range safety application for the Titan family (Titan II, Titan III, and Titan IV) of space launch vehicles. The design was accomplished in 1986/1987 under contract with Martin Marietta Corporation. Qualification tests were performed by Cincinnati Electronics Corporation during the period of December 1987 through March 1988.

3. TECHNICAL SPECIFICATIONS

3.1 INPUT SIGNAL CHARACTERISTICS

3.1.1	Type	Frequency-modulated UHF command transmission
3.1.2	Command Format	Eleven sequential character command codes (high-alphabet)
3.1.3	Character Definition	Each character is comprised of two audio tone frequencies for a duration of 6-2/3 ms
3.1.4	Audio Tone Frequencies	

TONE	FREQUENCY
1	7.35 kHz
2	8.40 kHz
3	9.45 kHz
4	10.50 kHz
5	11.55 kHz
6	12.60 kHz
7	13.65 kHz
Pilot Tone	15.45 kHz

3.2 RF SECTION

3.2.1	Frequency Range	400 to 550 MHz
3.2.2	Threshold Sensitivity	3 μV (1 μV typical)
3.2.3	Maximum Useable RF	1 Vrms
3.2.4	Operating Bandwidth	±45 kHz minimum
3.2.5	Antenna Impedance	50 ohms

3.2.6	VSWR	2.0:1
3.2.7	Local Oscillator Stability	0.0025 percent
3.2.8	Tuning Accuracy	0.005 percent
3.2.9	Tuning Method	Continuous (crystal-controlled)
3.3	IF SECTION	
3.3.1	IF Frequency	21.4 MHz
3.3.2	Selectivity, 3 dB BW 60 dB BW	180 kHz (minimum) 360 kHz (maximum)
3.3.3	Capture Ratio	<0.8
3.4	AUDIO SECTION	
3.4.1	Audio Amplifier Response	1 dB, 5 to 15 kHz
3.4.2	Audio Amplifier Distortion	<2 percent
3.4.3	Audio Output	None
3.4.4	Frequency Deviation	±30 kHz peak per tone
3.5	DETECTOR/DECODER SECTION	
3.5.1	Number of Decoder Channels	7 (high-alphabet tones)
3.5.2	Number of Simultaneous Useable Tones	High-alphabet message
3.5.3	Tone Filter Implementation	Microprocessor-controlled digital filter
3.5.4	Tone Channel Bandwidth	150 Hz minimum effective BW
3.5.5	Logic Circuitry	Microprocessor-controlled programmable decoding
3.5.6	Code Insertion	Field programmable with KYK-13 and adapter

3.5.7	Code Verification	Only when new code is entered
3.5.8	Memory	Non-volatile
3.5.9	Command Validity	Unit provides output only when input code matches prestored code
3.6	OUTPUT	
3.6.1	Types of Output	Transistor Switch
3.6.2	Output Current Capability	
	Destruct Output	54 A for 250 ±10 ms, B+ less 2 V
	Arm Output	5 A continuous
	OC Output	0.5 A continuous
3.6.3	Output Leakage	1 mA (maximum)
3.6.4	Output Isolation	3 Mohm (minimum)
3.6.5	Noise Immunity	Yes - software programmable variable threshold
3.6.6	Telemetry Outputs	
	Pilot Tone Command	0 V for No Command, 5 V for Command
	RF Signal Strength	0 V to 4.75 V precision telemetry (goes to >5 V with Destruct Command)
3.7	POWER SUPPLY	
3.7.1	Supply Voltage	22 to 38 Vdc
3.7.2	Power Consumption	Standby: 0.42 A Interrogate: 0.42 A
3.7.3	Power Supply Isolation	Yes, dc-to-dc converter
3.8	ELECTROMAGNETIC INTERFERENCE	
3.8.1	RFI Suppression	Meets MIL-STD-461A
3.8.2	AM Rejection	50 percent, 3 μV or more

3.8.3	Image Rejection	60 dB (minimum), 100 dB typical
3.8.4	Spurious Response Rejection	80 dB (minimum), 100 dB typical
3.9	ENVIRONMENTAL CHARACTERISTICS	
3.9.1	Operating Temperature Range	-7°C to +52°C
3.9.2	Nondestructive Temperatures (Shelf Storage)	-50°C to +55°C
3.9.3	Humidity	100 percent
3.9.4	Shock	960 g at 2,000 Hz
3.9.5	Vibration	15.6 g rms random
3.9.6	Pressurization	Not required
3.9.7	Shelf Life	3 years
3.10	PHYSICAL CHARACTERISTICS	
3.10.1	Volume	<111-in^3
3.10.2	Dimensions	3.32 x 7.60 x 4.40-in (plus connector protrusions)
3.10.3	Weight	5 pounds maximum
3.10.4	Mounting Attitude	Any
3.10.5	External Adjustments	None
3.10.6	Connector Types	
	J1, RF Input	N-Series
	J2, Power	MS3112E-14-19
	J3, Command Outputs	MS3112E-6-10PW
	J4, Code Insertion	MS3112E-14-19SW

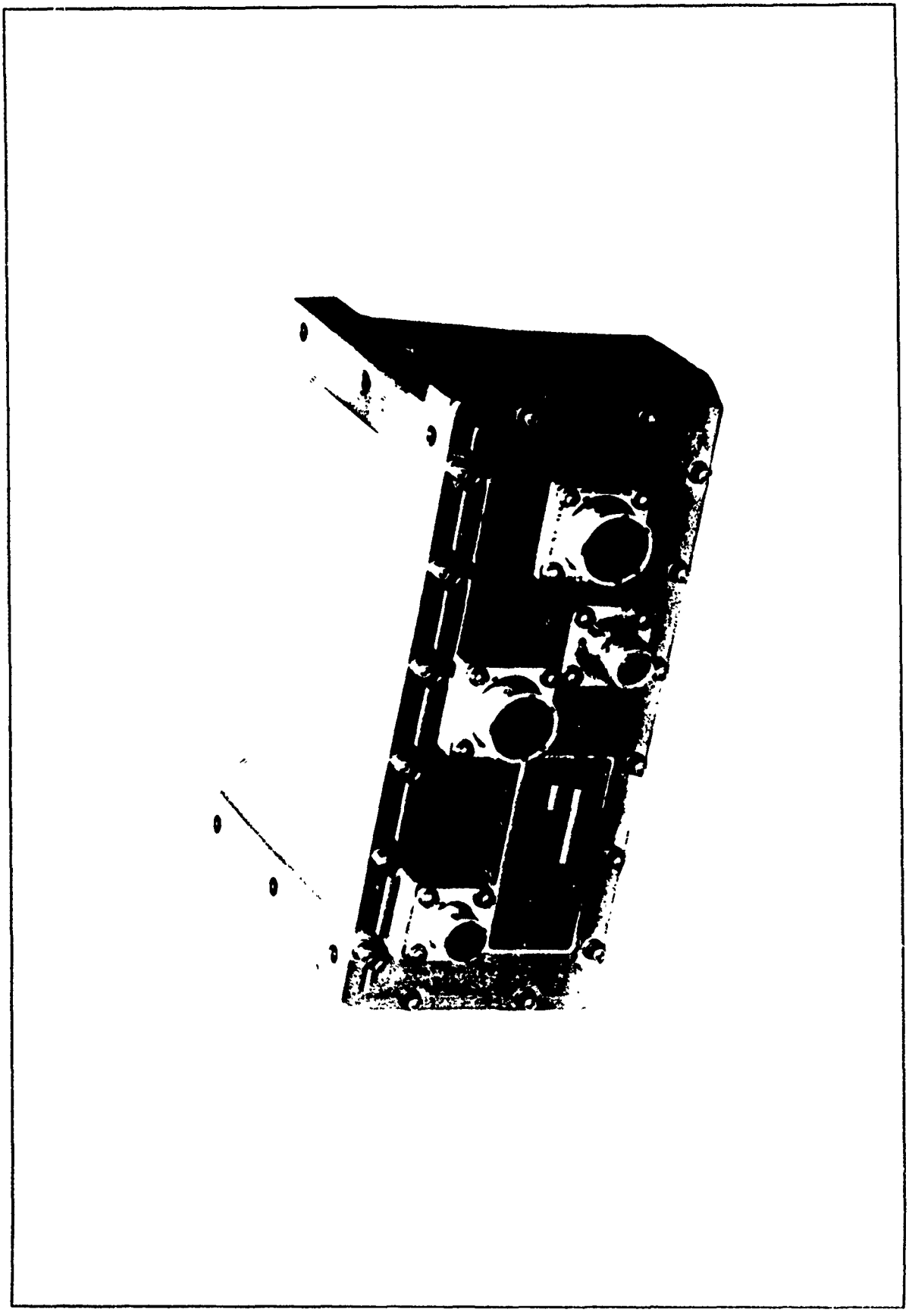


Figure 3-8. Cincinnati Electronics Corporation Model CRD-117/203 Command Receiver/Decoder.

CINCINNATI ELECTRONICS CORPORATION

COMMAND RECEIVER/DECODER

MODEL CRD-118/204

1. GENERAL DESCRIPTION

The Cincinnati Model CRD-118/204 Command Receiver/Decoder is a single-conversion superheterodyne design. Surface Acoustic Wave (SAW) filters incorporated in the receiver preselector and an IF of 21.4 MHz provide exceptional image rejection and spurious response performance.

The "high-alphabet" tone frequency detection is accomplished by a microprocessor and associated circuitry. The audio signal as recovered by the receiver section is digitized and processed using a Fast Fourier Transform (FFT) algorithm. The tone detection threshold self-adjusts to the signal and noise characteristics of the audio signal. This provides excellent tone detection performance for the seven audio tones used in the modulation format. In addition, detection of a "Pilot Tone" is accomplished, and a telemetry indication of its presence is provided.

The message decoding is accomplished by a microprocessor and associated circuitry. The sequence of detected characters (a character consists of two simultaneously transmitted tones) is compared with the prestored code-of-the-mission. If the comparison is favorable, a command output is issued; if the sequence does not compare, no command is issued. A non-volatile memory is contained within the unit to store the selected 11 character codes. This unit is field-programmed with a KYK-13 Electronic Transfer Device, and it provides automatic verification to the programming device whenever a new code is entered.

Some additional features incorporated in the unit design include:

- Power Changeover Function - An internal/external signal input causes the receiver to switch to either ground power source or vehicle battery.
- Inadvertent Separation Destruct Signal (ISDS) - When two of three break wires show vehicle break-up, the unit issues Arm/Destruct Command sequence.
- Delayed Destruct - A destruct output delayed by 30 ms from the primary destruct output.

Redundant 10 A outputs via transistor switches are provided for Arm, Destruct, and Delayed Destruct commands.

A precision signal strength telemetry output is also provided. Under control of the microprocessor, the AGC voltage level and unit temperature data are processed to provide a 0 to 5 V, linear, temperature stable, signal as an indication of the receiver RF input signal strength to within ±2 dB.

The unit is packaged in an aluminum cast housing. The mounting surface contains four 0.281-inch diameter holes on 5.5 x 6.0-inch centers.

2. BACKGROUND

The Model CRD-118/204 Command Receiver/Decoder was developed and qualified for range safety application for the Atlas II space launch vehicle. The design was accomplished in 1990 under contract with General Dynamics. Qualification tests were completed in mid 1991.

3. TECHNICAL SPECIFICATIONS

3.1 INPUT SIGNAL CHARACTERISTICS

3.1.1	Type	Frequency-modulated UHF command transmission
3.1.2	Command Format	Eleven sequential character command codes (high-alphabet)
3.1.3	Character Definition	Each character is comprised of two audio tone frequencies for a duration of 6-2/3 ms

3.1.4 Audio Tone Frequencies

TONE	FREQUENCY
1	7.35 kHz
2	8.40 kHz
3	9.45 kHz
4	10.50 kHz
5	11.55 kHz
6	12.60 kHz
7	13.65 kHz
Pilot Tone	15.45 kHz

3.2 RF SECTION

3.2.1	Frequency Range	400 to 550 MHz
3.2.2	Threshold Sensitivity	1 μV (0.3 μV typical)

3.2.3	Maximum Useable RF	1 Vrms
3.2.4	Operating Bandwidth	±45 kHz minimum
3.2.5	Antenna Impedance	50 ohms
3.2.6	VSWR	2.0:1 (maximum)
3.2.7	Local Oscillator Stability	0.0025 percent
3.2.8	Tuning Accuracy	0.005 percent
3.2.9	Tuning Method	Continuous (crystal-controlled)
3.3	IF SECTION	
3.3.1	IF Frequency	21.4 MHz
3.3.2	Selectivity, 3 dB BW 60 dB BW	180 kHz (minimum) 360 kHz (maximum)
3.3.3	Capture Ratio	>0.8
3.4	AUDIO SECTION	
3.4.1	Audio Amplifier Response	1 dB, 5 to 15 kHz
3.4.2	Audio Amplifier Distortion	<2 percent
3.4.3	Audio Output	None
3.4.4	Frequency Deviation	±30 kHz peak per tone
3.5	DETECTOR/DECODER SECTION	
3.5.1	Number of Decoder Channels	7 (high-alphabet tones)
3.5.2	Number of Simultaneous Useable Tones	High-alphabet message & Pilot Tone
3.5.3	Tone Filter Implementation	Microprocessor-controlled digital filter

3.5.4	Tone Channel Bandwidth	150 Hz minimum effective BW
3.5.5	Logic Circuitry	Microprocessor-controlled programmable decoding
3.5.6	Code Insertion	Field programmable with KYK-13 and adapter
3.5.7	Code Verification	Only when new code is entered
3.5.8	Memory	Non-volatile
3.5.9	Command Validity	Unit provides output only when input code matches prestored code
3.6	OUTPUT	
3.6.1	Types of Output	Transistor Switch
3.6.2	Output Current Capability	
	Destruct Output	10 A (each output)
	Delay Destruct	10 A (each output)
	Arm Output	10 A (each output)
	Disable Output	0.25 A
3.6.3	Output Leakage	10 mA (maximum)
3.6.4	Output Isolation	3.0 Mohm (minimum)
3.6.5	Noise Immunity	Yes - software programmable variable threshold
3.6.6	Telemetry Outputs	
	Pilot Tone Command	0 V for No Command, 5 V for Command
	RF Signal Level	0 V to 4.75 V precision telemetry
	Temperature	0-5 Vdc linear, 0 Vdc for -40°C to 5 Vdc for +85°C
	ARM	28 Vdc with Command, 0 Vdc no Command
	DESTRUCT	28 Vdc with Command, 0 Vdc no Command
	DELAY DESTRUCT	28 Vdc with Command, 0 Vdc no Command
	SELF TEST	28 Vdc with Command, 0 Vdc no Command
	DISABLE	28 Vdc with Command, 0 Vdc no Command
	Internal/External	28 Vdc with Command, 0 Vdc no Command
	Reset	28 Vdc with Command, 0 Vdc no Command

3.7	POWER SUPPLY	
3.7.1	Supply Voltage	22 to 38 Vdc
3.7.2	Power Consumption	Standby: 0.16 A Interrogate: 0.16 A (plus output current)
3.7.3	Power Supply Isolation	Yes, dc-to-dc converter
3.8	ELECTROMAGNETIC INTERFERENCE	
3.8.1	RFI Suppression	Meets MIL-STD-461A
3.8.2	AM Rejection	100 percent, 3 μV or more
3.8.3	Image Rejection	60 dB (minimum), 100 dB typical
3.8.4	Spurious Response Rejection	80 dB (minimum), 100 dB typical
3.9	ENVIRONMENTAL CHARACTERISTICS	
3.9.1	Operating Temperature Range	-65°C to +185°C
3.9.2	Nondestructive Temperatures (Shelf Storage)	-65°C to +160°C
3.9.3	Humidity	100 percent
3.9.4	Shock	2,000 g at 1,200 Hz
3.9.5	Vibration	27.8 g rms random
3.9.6	Pressurization	Not required
3.9.7	Shelf Life	10 years
3.10	PHYSICAL CHARACTERISTICS	
3.10.1	Volume	<115-in^3
3.10.2	Dimensions	2.45 x 7.50 x 6.00-in (see Outline Drawing)

3.10.3	Weight	5 pounds maximum
3.10.4	Mounting Attitude	Any
3.10.5	External Adjustments	None
3.10.6	Connector Types	
	J1, RF Input	TNC M39012/32-0001
	J2, Power	MS27505E-15-F19PC
	J3, Command Outputs	MS27505E-15-F19S
	J4, Command Outputs	MS27505E-15-F19SA
	J5, Telemetry	MS27505E-15-F19SB
	J6, Code Insertion	MS3112E-10-6PW
	J7, ISDS Enable	MS27505E-9-F35S
	J8, ISDS Sensing	MS27505E-9-F35PA

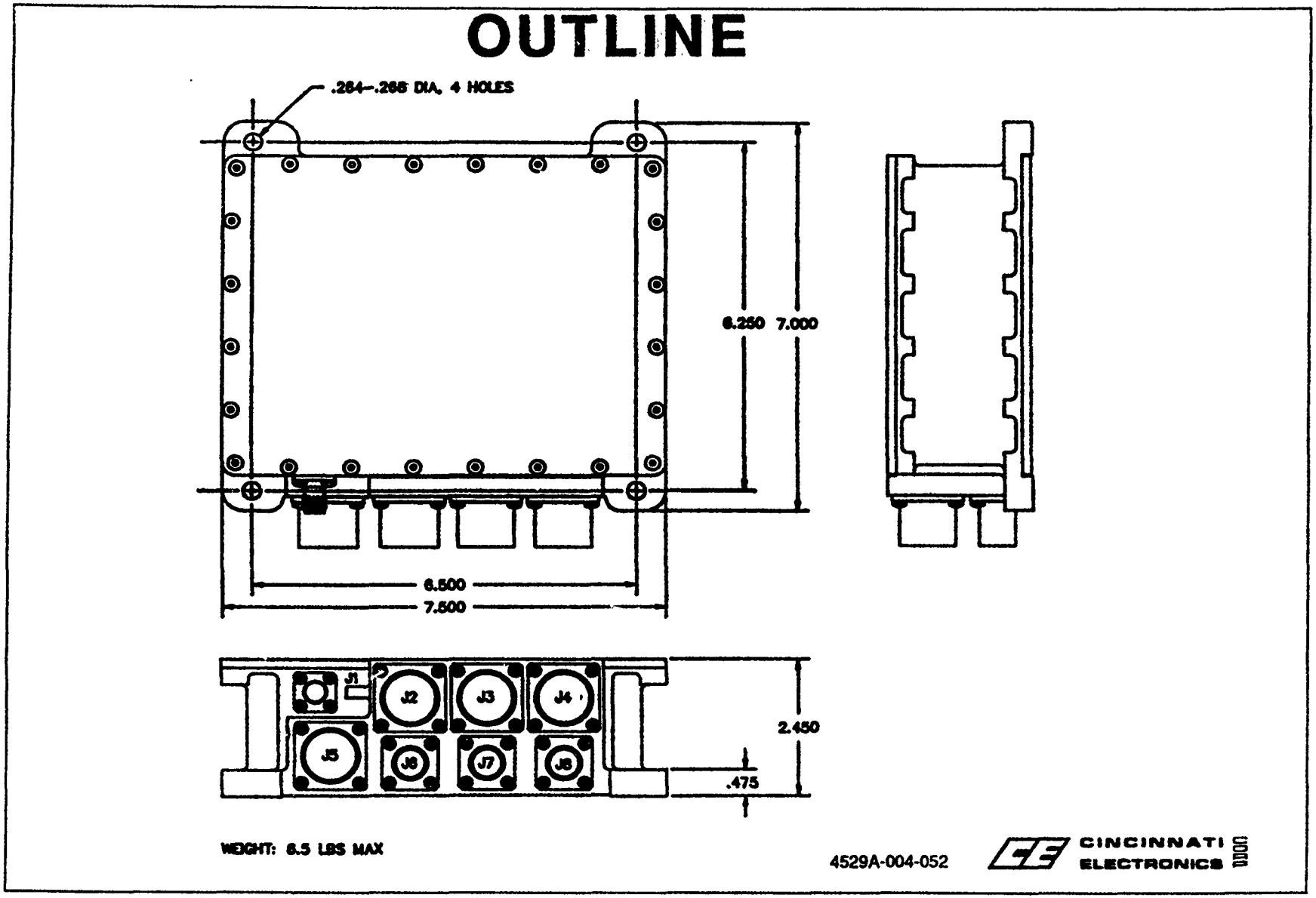


Figure 3-9. Outline drawing of Cincinnati Electronics Corporation Model CRD-118/204 Command Receiver/Decoder.

Figure 3-10. Cincinnati Electronics Corporation Model CRD-118/204 Command Receiver/Decoder.

CINCINNATI ELECTRONICS CORPORATION

COMMAND RECEIVER/DECODER

MODEL CRD-120/205

1. GENERAL DESCRIPTION

The Cincinnati Model CRD-120/205 Command Receiver/Decoder is a single-conversion superheterodyne design. Surface Acoustic Wave (SAW) filters incorporated in the receiver preselector and an IF of 21.4 MHz provide exceptional image rejection and spurious response performance.

The "high-alphabet" tone frequency detection is accomplished by a microprocessor and associated circuitry. The audio signal as recovered by the receiver section is digitized and processed using a Fast Fourier Transform (FFT) algorithm. The tone detection threshold self-adjusts to the signal and noise characteristics of the audio signal. This provides excellent tone detection performance for the seven audio tones used in the modulation format. In addition, detection of a "Pilot Tone" is accomplished, and a telemetry indication of its presence is provided.

The message decoding is accomplished by a microprocessor and associated circuitry. The sequence of detected characters (a character consists of two simultaneously transmitted tones) is compared with the prestored code-of-the-mission. If the comparison is favorable, a command output is issued; if the sequence does not compare, no command is issued. A non-volatile memory is contained within the unit to store the selected 11 character codes. This unit is field-programmed with a KYK-13 Electronic Transfer Device, and it provides automatic verification to the programming device whenever a new code is entered.

Some additional features incorporated in the unit design include:

- Power Changeover Function - An internal/external signal input causes the receiver to switch to either ground power source or vehicle battery.
- Inadvertent Separation Destruct Signal (ISDS) - When two of four break wires show vehicle break-up, the unit issues Arm/Destruct Command sequence.
- Electro-explosive Device (EED) Monitor - The unit contains a circuit that measures the resistance of the external load on the Destruct Outputs and provides and provides this data via telemetry signals.

Redundant 10 A outputs via transistor switches are provided for Destruct Command, and redundant 1 A transistor switches are provided for the Arm Command.

A precision signal strength telemetry output is also provided. Under control of the microprocessor, the AGC voltage level and unit temperature data are processed to provide a 0 to 5 V, linear, temperature stable, signal as an indication of the receiver RF input signal strength to within ±2 dB.

The unit is packaged in an aluminum cast housing. The mounting surface contains four 0.281-inch diameter holes on 6.25 x 6.50-inch centers.

2. BACKGROUND

The Model CRD-120/205 Command Receiver/Decoder is for range safety application for the Delta II space launch vehicle. This design is being accomplished in 1992 under contract with McDonnell Douglas Space Systems Company. Qualification tests are scheduled to take place in the early part of 1993.

3. TECHNICAL SPECIFICATIONS

3.1 INPUT SIGNAL CHARACTERISTICS

3.1.1	Type	Frequency-modulated UHF command transmission
3.1.2	Command Format	Eleven sequential character command codes (high-alphabet)
3.1.3	Character Definition	Each character is comprised of two audio tone frequencies for a duration of 6-2/3 ms

3.1.4 Audio Tone Frequencies

TONE	FREQUENCY
1	7.35 kHz
2	8.40 kHz
3	9.45 kHz
4	10.50 kHz
5	11.55 kHz
6	12.60 kHz
7	13.65 kHz
Pilot Tone	15.45 kHz

3.2	RF SECTION	
3.2.1	Frequency Range	400 to 550 MHz
3.2.2	Threshold Sensitivity	3 µV (signals less than 1 µV will not be decoded)
3.2.3	Maximum Useable RF	1 Vrms
3.2.4	Operating Bandwidth	±45 kHz minimum
3.2.5	Antenna Impedance	50 ohms
3.2.6	VSWR	2.0:1 (maximum)
3.2.7	Local Oscillator Stability	0.0025 percent
3.2.8	Tuning Accuracy	0.005 percent
3.2.9	Tuning Method	Crystal-controlled
3.3	IF SECTION	
3.3.1	IF Frequency	21.4 MHz
3.3.2	Selectivity, 3 dB BW 60 dB BW	180 kHz (minimum) 360 kHz (maximum)
3.3.3	Capture Ratio	>0.8
3.4	AUDIO SECTION	
3.4.1	Audio Amplifier Response	1 dB, 5 to 15 kHz
3.4.2	Audio Amplifier Distortion	<2 percent
3.4.3	Audio Output	None
3.4.4	Frequency Deviation	±30 kHz peak per tone

3.5	DETECTOR/DECODER SECTION	
3.5.1	Number of Decoder Channels	7 (high-alphabet tones)
3.5.2	Number of Simultaneous Useable Tones	High-alphabet message & Pilot Tone
3.5.3	Tone Filter Implementation	Microprocessor-controlled digital filter
3.5.4	Tone Channel Bandwidth	150 Hz minimum effective BW
3.5.5	Logic Circuitry	Microprocessor-controlled programmable decoding
3.5.6	Code Insertion	Field programmable with KYK-13 and adapter
3.5.7	Code Verification	Only when new code is entered
3.5.8	Memory	Non-volatile
3.5.9	Command Validity	Unit provides output only when input code matches prestored code
3.6	OUTPUT	
3.6.1	Types of Output	Transistor Switch
3.6.2	Output Current Capability	
	Destruct Output	10 A (each of two separate outputs)
	Arm Output	1 A (each of two separate outputs)
3.6.3	Output Leakage	10 mA (maximum)
3.6.4	Output Isolation	3 Mohm (minimum)
3.6.5	Noise Immunity	Yes - software programmable variable threshold

3.6.6 Telemetry Outputs

Pilot Tone Command	0 V for no Command, 4.5 V for Command
RF Signal Level	0 V to 4.75 V precision telemetry
Power Voltage Monitor	0 V to 4.5 V linear, 0 V for 24 Vdc B+, 4.5 V for 32 Vdc B+
Temperature Monitor	0 to 4.85 V linear, 0 V for -40°C, 4.85 V for +85°C
EED Monitor	0 V to 4.5 V, proportional to resistance across Destruct output 0.5 V for 1 ohm, 3.5 V for 25 ohms (active only for 5 seconds after self-test)
Battery Voltage Monitor	Differential Output, 0 mV for 0 Vdc, 100 mV for 40 Vdc
Input Current Monitor	Differential Output, 0 mV for 0 A, 50 mV for 10 A
ARM	4.5 V with Command, 0 V no Command
DESTRUCT	4.5 V with Command, 0 V no Command
Disable	4.5 V with Command, 0 V no Command
Reset	4.5 V with Command, 0 V no Command
Self Test	4.5 V for 15 seconds following Command, 0 V for no Command
ISDS Loop	4.5 V for closed breakwire, 0 V for open breakwire
ISDS Safe/Arm	4.5 V for ISDS Armed, 0 V for ISDS not Armed
INTERNAL ON	4.5 V for ON condition, 0 V for OFF

3.7	POWER SUPPLY	
3.7.1	Supply Voltage	24 to 35 Vdc
3.7.2	Power Consumption	Standby: 0.16 A Interrogate: 0.16 A (plus output current)
3.7.3	Power Supply Isolation	Yes, dc-to-dc converter
3.8	ELECTROMAGNETIC INTERFERENCE	
3.8.1	RFI Suppression	Meets MIL-STD-461B
3.8.2	AM Rejection	100 percent, 3 μV or more
3.8.3	Image Rejection	60 dB (minimum), 100 dB typical
3.8.4	Spurious Response Rejection	80 dB (minimum), 100 dB typical
3.9	ENVIRONMENTAL CHARACTERISTICS	
3.9.1	Operating Temperature Range	-34°C to +71°C
3.9.2	Nondestructive Temperatures (Shelf Storage)	-34°C to +71°C
3.9.3	Humidity	100 percent
3.9.4	Shock	1,000 g (0.8 to 3.0 kHz)
3.9.5	Vibration	33.4 g rms random
3.9.6	Pressurization	Not required
3.9.7	Shelf Life	10 years
3.10	PHYSICAL CHARACTERISTICS	
3.10.1	Volume	<160-in^3
3.10.2	Dimensions	3.0 x 7.0 x 7.5-in

3.10.3	Weight	5.5 pounds (typical)
3.10.4	Mounting Attitude	Any
3.10.5	External Adjustments	None
3.10.6	Connector Types	
	J1, RF Input	TNC M39012/32-0001
	J2, Power	MS27505E-15-F19PC
	J3, Telemetry	MS27505E-13-F35S
	J4, Code Insertion	MS3112E-10-6PW
	J5, ARM	ST396R8N4SN
	J6, ISDS Breakwire A	MS27505-9-F35SA
	J7, ISDS Breakwire B	MS27505E-9-F35S
	J8, DESTRUCT	ST222R10N3SY
	J9, DESTRUCT B	ST222R10N3SN

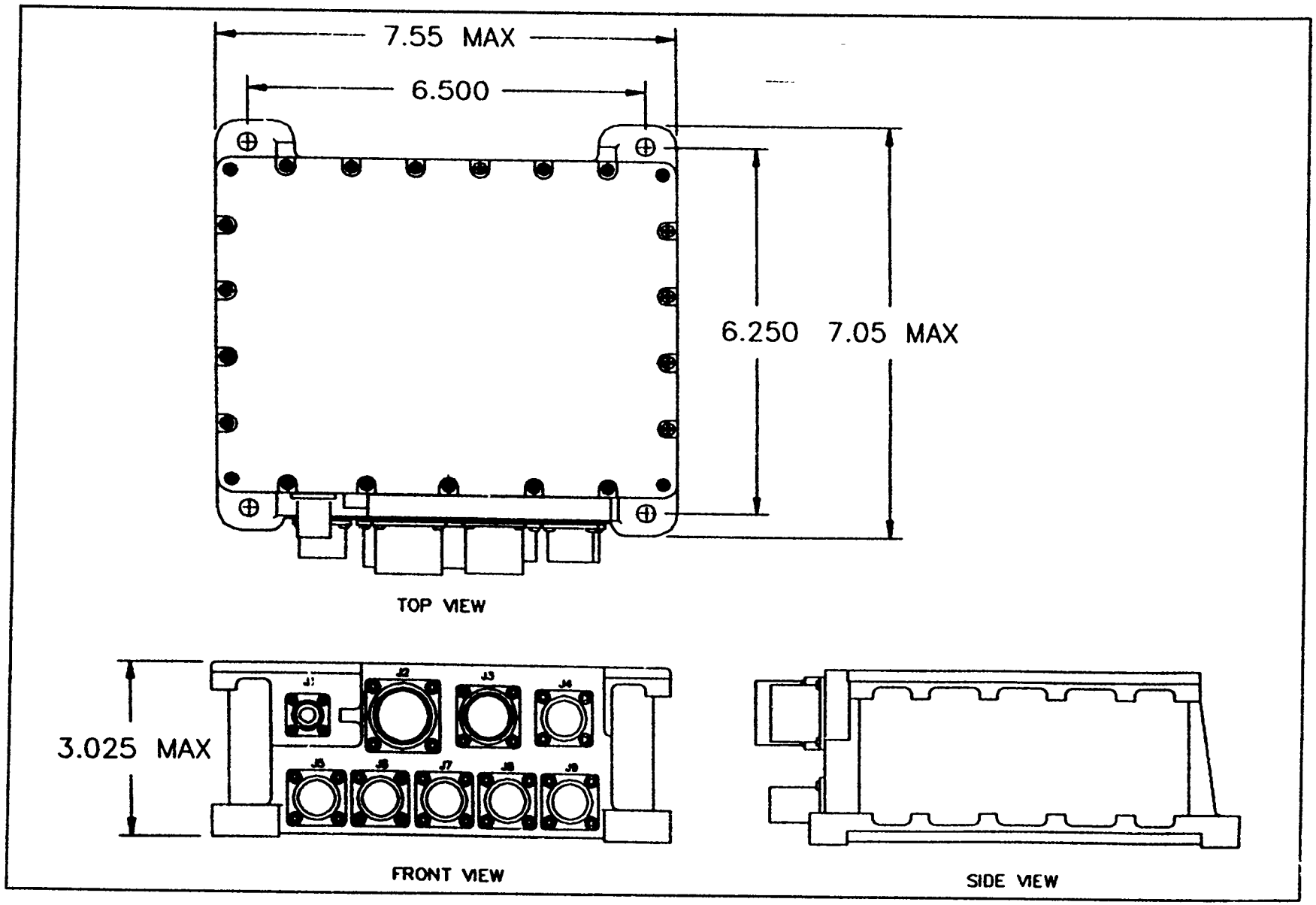


Figure 3-11. Outline drawing of Cincinnati Electronics Corporation Model CRD-120/205 Command Receiver/Decoder.

4. LORAL CONIC
9020 Balboa Ave.
San Diego, CA 92123-1595
(Phone: 619-279-0411)

FLIGHT TERMINATION RECEIVERS

Model FTR-515

Model FTR-550

Model FTR-551

Model FTR-575

Model FTR-905

Model FTR-915

COMMAND DESTRUCT RECEIVERS

Model CCR-200

Model CDR-200

Model CDR-222

Model CDR-555

LORAL CONIC

FLIGHT TERMINATION RECEIVER

MODEL FTR-515

1. GENERAL DESCRIPTION

The Loral Conic Model FTR-515 Flight Termination Receiver is designed for missile range safety usage on programs with stringent environmental requirements. The design comprises a dual-conversion receiver, phase-locked tone decoders and relay logic. The unit also features fail-safe circuits for both carrier and power. Several design versions of the FTR-515 exist offering solid state outputs, power control and wider IF bandwidth for external audio/decoder interface.

2. BACKGROUND

The Model FTR-515 Flight Termination Receiver has been used on the AMRAAM program. Later configurations of the design have been used on HEDI, Pershing II, Eris, FOGM, and ERINT.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	405 to 486 MHz
3.1.2	Threshold Sensitivity (Command Output)	1 μV
3.1.3	Maximum Useable RF Input	2 Vrms
3.1.4	Operating Bandwidth	±45 kHz
3.1.5	Antenna Impedance	50 ohms (nominal)
3.1.6	VSWR	2:1 maximum
3.1.7	Local Oscillator Stability	±0.003 percent
3.1.8	Tuning Accuracy	±0.005 percent
3.1.9	Tuning Method	Fixed frequency, crystal-controlled

3.2	IF SECTION (DUAL CONVERSION)	109 MHz to 130 MHz 1st IF (center frequency controlled)
3.2.1	IF Frequency	10.7 MHz 2nd IF
3.2.2	Selectivity, 60 dB	±180 kHz maximum
3.2.3	Capture Ratio	<1 dB
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	500 Hz to 80 kHz
3.3.2	Audio Amplifier Distortion	<3 percent
3.3.3	Audio Output	1 Vp-p for 30 kHz peak deviation (selected configuration only)
3.3.4	Frequency Deviation	30 ±6 kHz peak per tone
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	-
3.4.2	Number of Simultaneous Useable Tones	3
3.4.3	Tone Channel Bandwidth	>±1 percent at 2 dB
3.4.4	Adjacent Channel Rejection	34 dB
3.4.5	Decoder Threshold Deviation	15 kHz (nominal)
3.5	OUTPUT	
3.5.1	Types of Output	Relay or solid-state (28 V out)
3.5.2	Output Current Capability	3 A relay 2 A solid-state 7.5 A peak 10 ms

3.5.3	Output Leakage	50 µA solid-state
3.5.4	Logic Circuit	Tone 1, Tone 3 = Logic Arm Tone 1 ON, Tone 3 OFF, Tone 2 ON = Destruct Other sequences available
3.5.5	Response Time for Commands	20 ms maximum
3.5.6	Transition Time Between Commands	<5 ms
3.5.7	Output Isolation	Power and command returns isolated from chassis (can be connected)
3.5.8	Noise Immunity	12 dB minimum noise margin on decoder channels for unquieted noise; removal of prime power enables fail-safe circuit; fail-safe circuit immune to EMI on power leads
3.5.9	Telemetry Outputs	
3.5.9.1	Signal Strength	No RF: 0.50 ±0.25 Vdc -101 dBm: 0.25 Vdc above no RF reading -40 dBm: 4.75 ±0.25 Vdc
3.5.9.2	Output Arm Monitor	28 Vdc (nominal) indicates relay logic arm condition
3.5.9.3	Output Enable Monitor	18 ±3 Vdc indicates command relay coil status
3.5.9.4	Tone Monitors	Monitor Tone Channel Status

AMRAAM Logic Only
Other Tone Monitor Levels Available

	Present	Absent
Tone 1	" 1 "	" 0 "
Tone 2	" 1 "	" 0 "
Tone 3	" 1 "	" 0 "

Logic "1" = 18 ±3 Vdc
Logic "0" = 0.0 to 0.5 Vdc

3.6	POWER SUPPLY	
3.6.1	Supply Voltage	22 to 35 Vdc
3.6.2	Power Requirements	200 mA standby; 300 mA command

3.6.3	Power Supply Isolation	Return connected to case or can be isolated greater than 1 Mohm
3.6.4	Turn-On Power Control for Receiver	Available by 28 V latching relay
3.6.5	Other Controls	Loss of carrier fail-safe (circuit can be enabled by using external transistor-transistor logic (TTL) level or internal level provided at connector)
3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461
3.7.2	Pulse Rejection	Not measured
3.7.3	AM Rejection	AM carriers will not cause command output
3.7.4	Image Rejection	60 dB minimum
3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-40°C to +77°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-65°C to +125°C
3.8.3	Humidity	95 percent
3.8.4	Altitude	Unlimited
3.8.5	Shock	60 g, 5 ms
3.8.6	Acceleration	40 g, each axis
3.8.7	Vibration	16 g rms, random
3.8.8	Acoustics	Not measured
3.8.9	Pressurization	Not measured

3.8.10	Operating Life	MTBF = 5,000 hours minimum
3.8.11	Shelf Life	5 years
3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	18-in^3
3.9.2	Dimensions	See Outline Drawing
3.9.3	Weight	22 ounces
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	RF Input (J1): SMA Power, Command (J2): DAH-15P-101 Subminiature connectors available

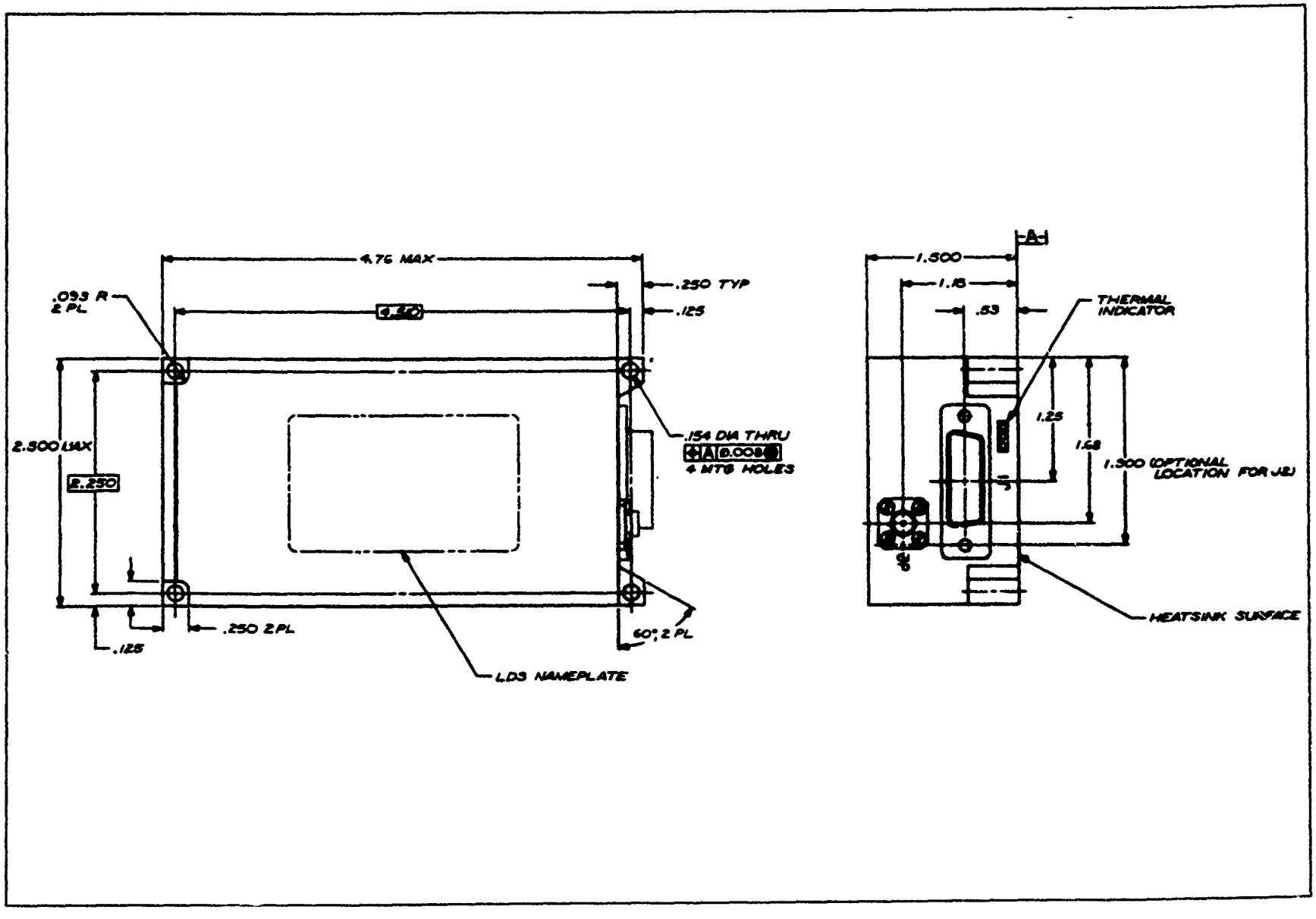


Figure 4-1. Outline drawing of LC Model FTR-515 Flight Termination Receiver.

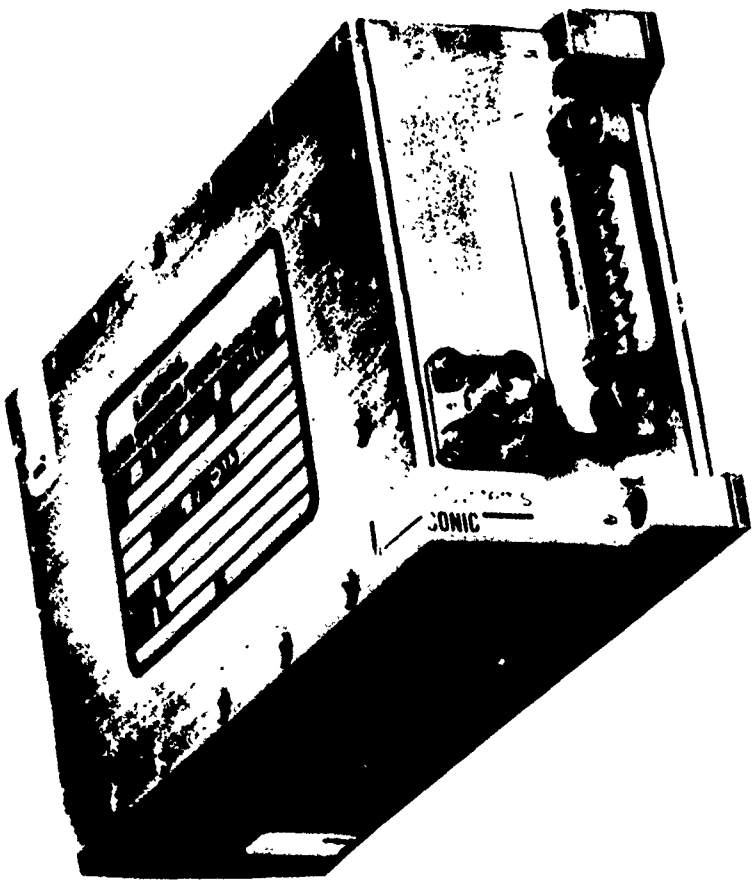


Figure 4-2. LC Model FTR-515 Flight Termination Receiver.

LORAL CONIC

FLIGHT TERMINATION RECEIVER

MODEL FTR-550

1. GENERAL DESCRIPTION

The Loral Conic Model FTR-550 Flight Termination Receiver is designed specifically for missile range safety usage on programs with stringent environmental and reliability requirements. The dual-conversion receiver, phase-locked tone decoders and logic circuitry are features of a design that meets the latest range requirements. Each unit undergoes extensive burn-in and acceptance testing prior to shipment. The FTR-550 is well suited for high-reliability applications where ruggedized, lightweight, miniature construction and high performance are required.

2. BACKGROUND

The Model FTR-550 is fully qualified to NAVAIR Drawing Number 642AS8859 in both solid-state and relay versions. The FTR-550 has been used the HARPOON, SLAM, SLAT, and VANDAL programs. The FTR-550 replaces the Loral Model CDR-200.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	405 to 486 MHz
3.1.2	Threshold Sensitivity (Command Output)	2 μV
3.1.3	Maximum Useable RF Input	2 Vrms
3.1.4	Operating Bandwidth	±45 kHz
3.1.5	Antenna Impedance	50 ohms (nominal)
3.1.6	VSWR	2:1 maximum
3.1.7	Local Oscillator Stability	±0.005 percent
3.1.8	Tuning Accuracy	±0.005 percent
3.1.9	Tuning Method	Fixed frequency. crystal-controlled

3.2	IF SECTION (DUAL CONVERSION)	109 MHz to 130 MHz 1st IF (center frequency controlled)
3.2.1	IF Frequency	10.7 MHz 2nd IF
3.2.2	Selectivity, 60 dB	±180 kHz maximum
3.2.3	Capture Ratio	<0.8 dB
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	500 Hz to 80 kHz
3.3.2	Audio Amplifier Distortion	<3 percent
3.3.3	Audio Output	N/A
3.3.4	Frequency Deviation	30 ±6 kHz peak per tone
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	3 (4 on request)
3.4.2	Number of Simultaneous Useable Tones	3 (4 on request)
3.4.3	Tone Channel Bandwidth	±1 percent minimum at 2 dB
3.4.4	Adjacent Channel Rejection	40 dB
3.4.5	Decoder Threshold Deviation	15 kHz (nominal)
3.5	OUTPUT	
3.5.1	Types of Output	Relay, 28 V (nominal) or solid-state
3.5.2	Output Current Capability	2 A per command all within 1 V of supply voltage for relay outputs. Solid-state within 2.5 V for destruct and 1.5 V for all other command outputs

3.5.3	Output Leakage	None - for relay 50 µA (maximum) (typically 0.5 µA) solid-state
3.5.4	Logic Circuit	1, 5 ON = Monitor, Arm 1 ON = Arm 2, 5 ON = Monitor, Optional 1, 2, 5 ON = Monitor, Arm, Optional 5 ON = Monitor 1, 2, 5 ON Remove 5 = Terminate, Arm
3.5.5	Response Time for Commands	15 ms (nominal); 25 ms (maximum)
3.5.6	Transition Time Between Commands	3 ms
3.5.7	Output Isolation	>1 Mohm from chassis
3.5.8	Noise Immunity	>12 dB for decoder channels on unquieted noise (interruption of primary power or RF power to unit will not cause relay closure)

3.5.9 Telemetry Outputs

With no RF input, the quiescent level is a nominal 0.50 ±0.25 V, increasing to a value not to exceed 4.75 ±0.25 V at an RF level of -40 dBm. The slope is positive and does not change direction over the RF signal dynamic range.

3.6	POWER SUPPLY	
3.6.1	Supply Voltage	24 to 36 Vdc
3.6.2	Power Requirements	180 mA standby; 300 mA for commands
3.6.3	Power Supply Isolation	1 Mohm from chassis and signal strength monitor
3.6.4	Turn-On Power Control for Receiver	N/A
3.6.5	Other Controls	N/A

3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461 for antenna, power and signal leads RS03: 20 V/m CS04, CS08: Limits A and B, 60 dB Meets MIL-STD-704, Category B, ripple frequency on power leads
3.7.2	Pulse Rejection	Immune to C-Band and X-Band radar transponder signals applied to antenna port at peak power levels of +27 dBm
3.7.3	AM Rejection	Application of carrier amplitude modulated up to 95 percent will not cause command outputs
3.7.4	Image Rejection	60 dB minimum
3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-54°C to +80°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-65°C to +125°C
3.8.3	Humidity	95 percent
3.8.4	Altitude/Temperature	100,000 feet minimum at -54°C
3.8.5	Shock	Relay 100 g, 6.0 ms Solid-state 1,100 g for 0.5 ms
3.8.6	Acceleration	100 g
3.8.7	Vibration	15 g-peak sinusoidal; 0.06 g^2 random or 10 g rms
3.8.8	Acoustics	Not measured
3.8.9	Pressurization	30 lb/in^2 30 minutes

3.8.10	Operating Life	MTBF = 5,000 hours minimum
3.8.11	Shelf Life	5 years
3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	25-in^3
3.9.2	Dimensions	See Outline Drawing
3.9.3	Weight	22 ounces maximum
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	RF Input (J1): TNC receptacle Power (J2): MS3112E-8-4P Command (J3): MS3112E-10-6S Monitor (J4): MS3112E-8-4S

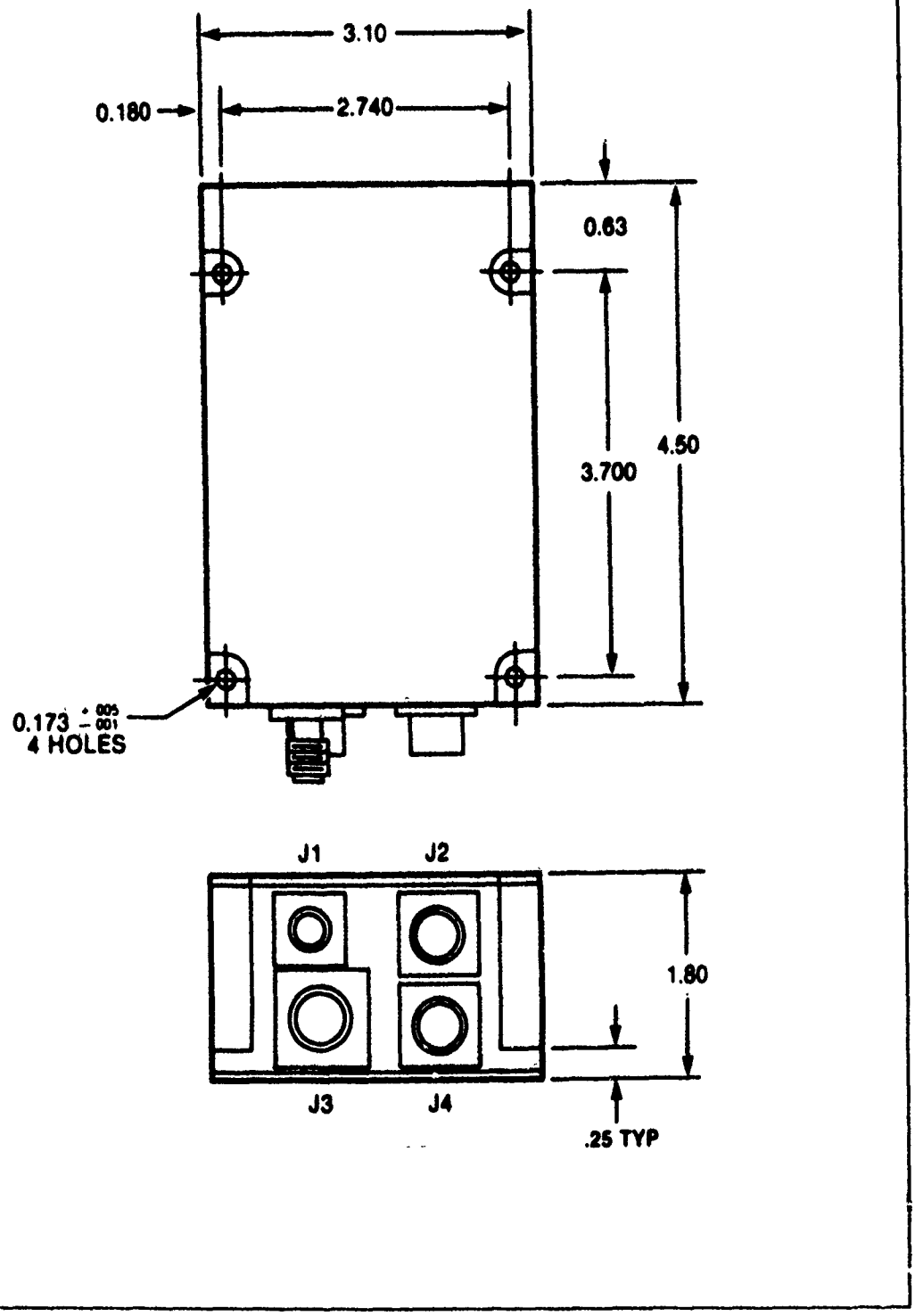


Figure 4-3. Outline drawing of LC Model FTR-550 Flight Termination Receiver.

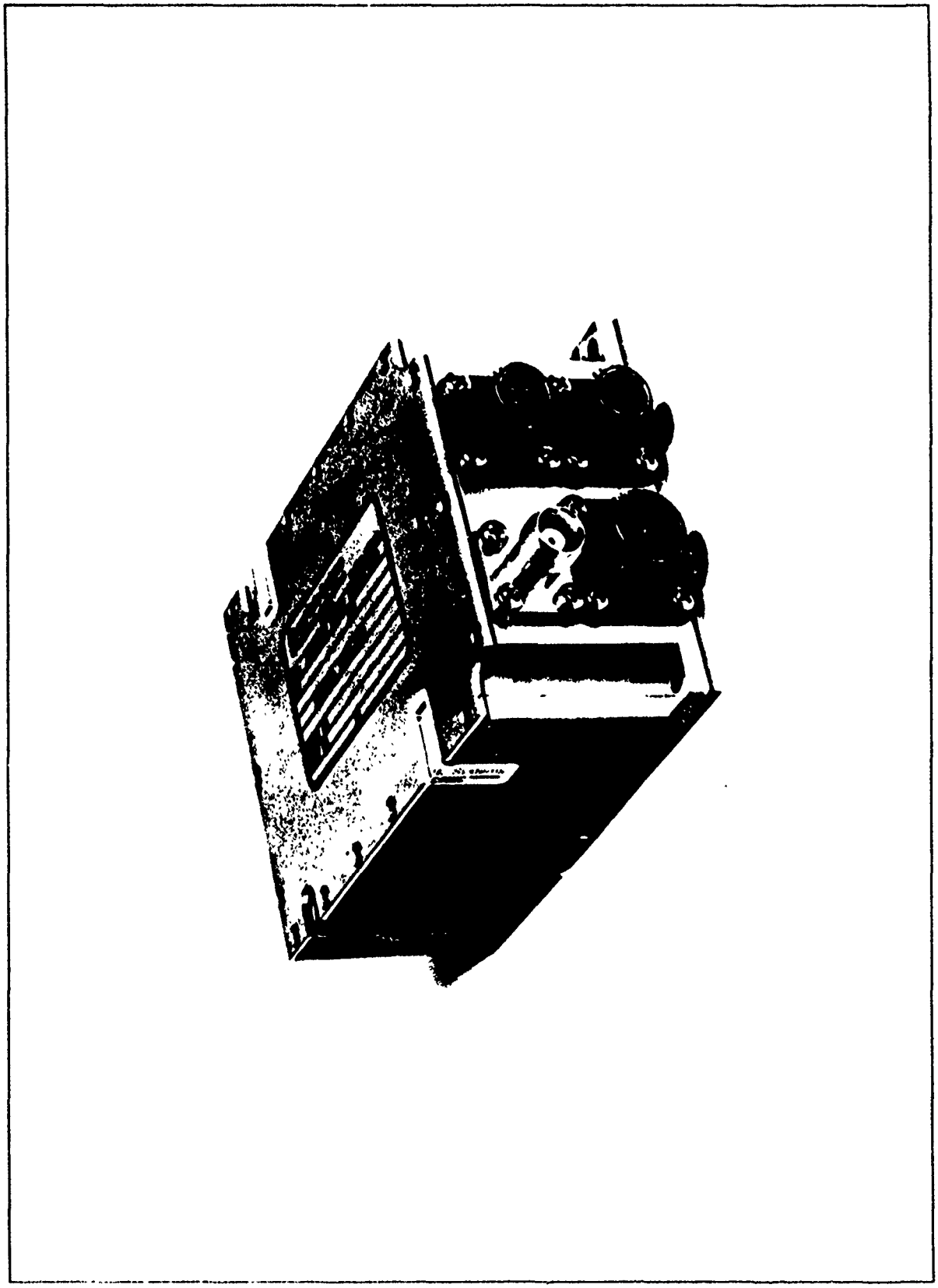


Figure 4-4. LC Model FTR-550 Flight Termination Receiver.

LORAL CONIC

FLIGHT TERMINATION RECEIVER

MODEL FTR-551

1. GENERAL DESCRIPTION

The Loral Conic Model FTR-551 Flight Termination Receiver is designed specifically for missile range flight safety usage on programs with stringent environmental and reliability requirements. The dual-conversion receiver, a tone decoder and logic circuitry comprise a design that meets the latest range requirements. Each unit undergoes extensive burn-in and acceptance testing prior to shipment. The FTR-551 is well suited for high-reliability applications where ruggedized, lightweight, miniature construction and high performance are required.

2. BACKGROUND

The Model FTR-551 is fully qualified to NAVAIR Drawing Number 1588AS103. The FTR-551 has been used with AQM-37C.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	405 to 486 MHz
3.1.2	Threshold Sensitivity (Command Output)	2 µV
3.1.3	Maximum Useable RF Input	2 Vrms
3.1.4	Operating Bandwidth	±45 kHz
3.1.5	Antenna Impedance	50 ohms (nominal)
3.1.6	VSWR	2:1 maximum
3.1.7	Local Oscillator Stability	±0.005 percent
3.1.8	Tuning Accuracy	±0.005 percent
3.1.9	Tuning Method	Fixed frequency, crystal-controlled

3.2	IF SECTION (DUAL CONVERSION)	
3.2.1	IF Frequency	109 MHz to 130 MHz 1st IF 10.7 MHz 2nd IF
3.2.2	Selectivity, 60 dB	±375 kHz maximum
3.2.3	Capture Ratio	<1 dB
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	500 Hz to 80 kHz
3.3.2	Audio Amplifier Distortion	<3 percent
3.3.3	Audio Output	1 Vp-p at 10 kHz
3.3.4	Frequency Deviation	30 ±6 kHz peak per tone
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	3
3.4.2	Number of Simultaneous Useable Tones	3
3.4.3	Tone Channel Bandwidth	±1 percent minimum at 2 dB
3.4.4	Adjacent Channel Rejection	40 dB
3.4.5	Decoder Threshold Deviation	16 kHz (nominal)
3.5	OUTPUT	
3.5.1	Types of Output	Solid-state
3.5.2	Output Current Capability	2.0 A per command within 2.5 V of supply voltage for destruct and 1.5 V for all other commands
3.5.3	Output Leakage	50 µA maximum

3.5.4	Logic Circuit	5 ON = Monitor 2, 5 ON = Monitor, Optional 1, 5 ON = Arm, Monitor 1, 2, 5 ON = Arm, Monitor, Optional 1, 2, 5 ON, 5 OFF = Arm, Terminate
3.5.5	Response Time for Commands	15 ms (nominal); 20 ms (maximum)
3.5.6	Transition Time Between Commands	3 ms
3.5.7	Output Isolation	>1 Mohm from chassis
3.5.8	Noise Immunity	12 dB minimum noise margin on decoder channels for unquieted noise; no command output will occur during application or removal of primary power

3.5.9 Signal Strength Telemetry Output

With no RF input, the quiescent level is a nominal 0.50 ±0.25 V, increasing to a value not to exceed 4.75 ±0.25 V at an RF level of -40 dBm. The slope is positive and does not change direction over the RF signal dynamic range.

3.6	POWER SUPPLY	
3.6.1	Supply Voltage	24 to 36 Vdc
3.6.2	Power Requirements	180 mA standby; 300 mA for commands
3.6.3	Power Supply Isolation	The unit has a minimum of 1 Mohm between: ° Case and primary power return ° Case and command outputs ° Case and signal strength telemetry ° Primary power return and signal strength telemetry
3.6.4	Turn-On Power Control for Receiver	N/A
3.6.5	Other Controls	N/A

3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461 for antenna, power and signal leads RS03: 20 V/m CS04, CS08: Limits A and B, 60 dB
3.7.2	Pulse Rejection	Specific band signal rejection at the antenna port Bands D & E at +10 dBm Bands G, H, I, & J at +40 dBm
3.7.3	AM Rejection	AM carriers will not cause command output
3.7.4	Image Rejection	60 dB minimum
3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-54°C to +80°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-65°C to +125°C
3.8.3	Humidity	95 percent
3.8.4	Altitude/Temperature	100,000 feet minimum at -54°C
3.8.5	Shock	100 g for 6 ms
3.8.6	Acceleration	100 g
3.8.7	Vibration	10 g random 15 g sine
3.8.8	Acoustics	Not measured
3.8.9	Pressurization	30 lb/in^2, 30 minutes
3.8.10	Operating Life	MTBF = 5,000 hours minimum
3.8.11	Shelf Life	5 years

3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	25-in^3
3.9.2	Dimensions	See Outline Drawing
3.9.3	Weight	22 ounces maximum
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	RF Input (J1): TNC receptacle Power (J2): MS3112E-8-4P Monitor (J3): MS3112E-10-6S Command (J4): MS3112E-8-4S

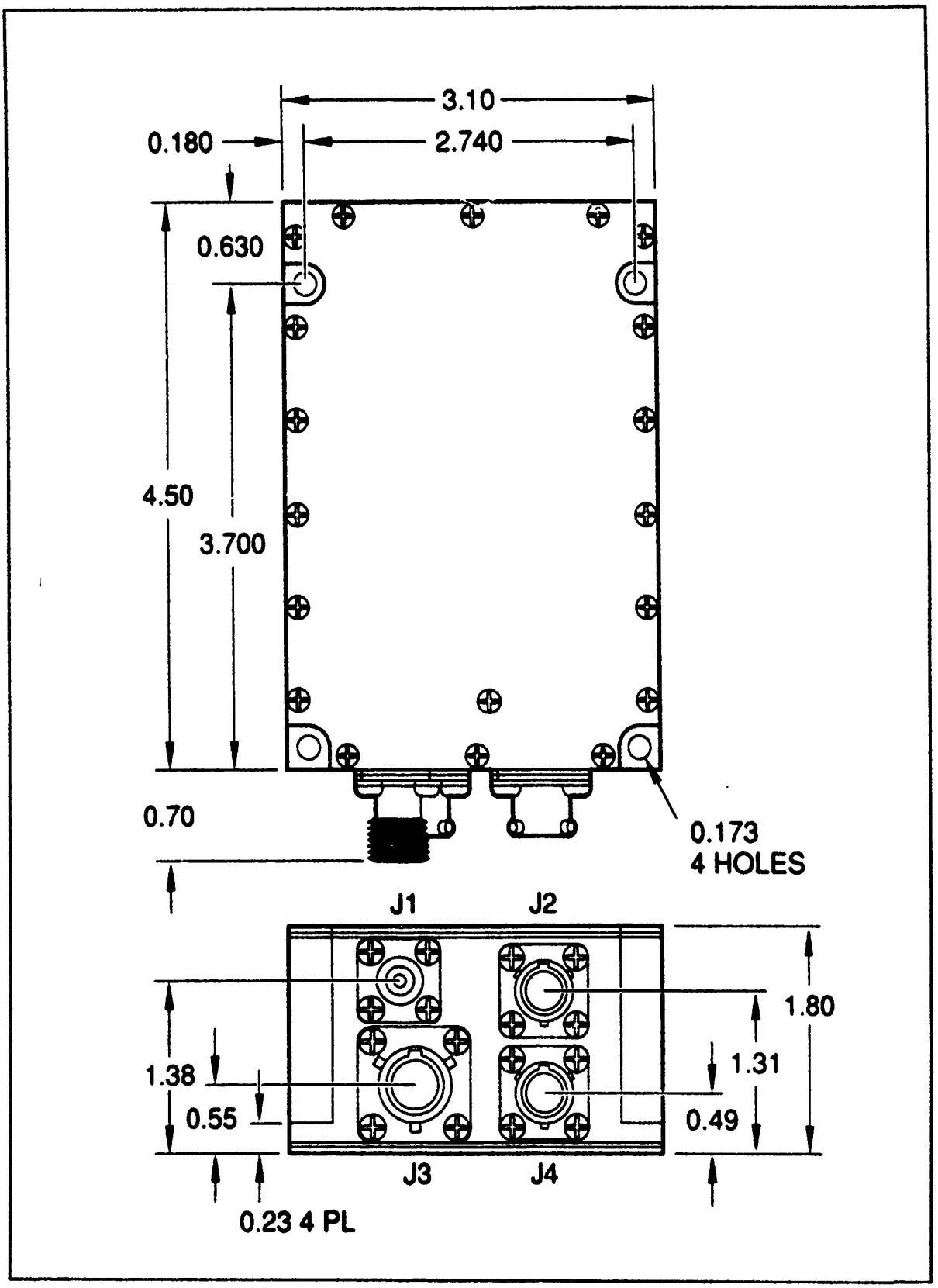


Figure 4-5. Outline drawing of LC Model FTR-551 Flight Termination Receiver.

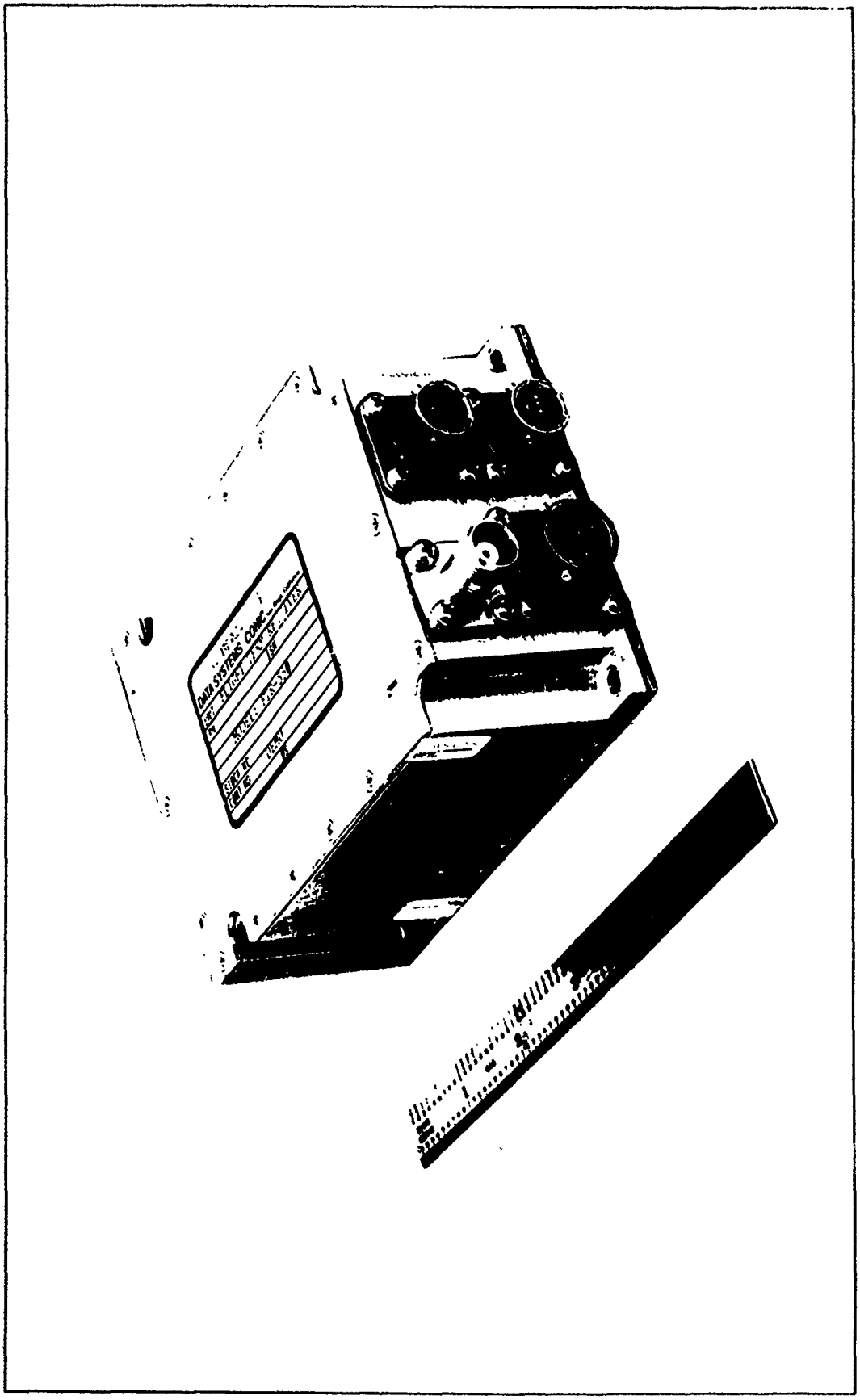


Figure 4-6. LC Model FTR-551 Flight Termination Receiver.

LORAL CONIC

FLIGHT TERMINATION RECEIVER

MODEL FTR-575

1. GENERAL DESCRIPTION

The Loral Conic Model FTR-575 Flight Termination Receiver is designed for missile range flight safety usage on programs with stringent environmental requirements. The FTR-575 is a redundant unit, each supplied by either of two antenna connectors via a RF power divider combiner. Phase-locked tone decoders and solid state output commands are featured in this unit.

2. BACKGROUND

The Model FTR-575 has used with SICBM. The unit is fully qualified.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	405 to 486 MHz
3.1.2	Threshold Sensitivity (Command Output)	3 μV
3.1.3	Maximum Useable RF Input	2 Vrms
3.1.4	Operating Bandwidth	±50 kHz
3.1.5	Antenna Impedance	50 ohms (nominal)
3.1.6	VSWR	1.5:1 maximum
3.1.7	Local Oscillator Stability	±0.003 percent
3.1.8	Tuning Accuracy	±0.003 percent
3.1.9	Tuning Method	Fixed frequency, crystal-controlled

3.2	IF SECTION (DUAL CONVERSION)	
3.2.1	IF Frequency	101.5 MHz 1st IF 10.7 MHz 2nd IF
3.2.2	Selectivity, 60 dB	±180 kHz maximum
3.2.3	Capture Ratio	<1 dB
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	500 Hz to 80 kHz
3.3.2	Audio Amplifier Distortion	<3 percent
3.3.3	Audio Output	N/A
3.3.4	Frequency Deviation	30 ±6 kHz peak per tone
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	4
3.4.2	Number of Simultaneous Useable Tones	4
3.4.3	Tone Channel Bandwidth	>1 percent at 2 dB
3.4.4	Adjacent Channel Rejection	34 dB
3.4.5	Decoder Threshold Deviation	14 kHz (nominal)
3.5	OUTPUT	
3.5.1	Types of Output	Solid-state
3.5.2	Output Current Capability	1 A
3.5.3	Output Leakage	50 µA maximum
3.5.4	Logic Circuit	Tone 4 = Check Tone 1, Tone 2, Tone 3 = Arm Tone 1, Tone 2, Tone 3 OFF = Arm, Destruct

3.5.5	Response Time for Commands	15 ms maximum
3.5.6	Transition Time Between Commands	<5 ms
3.5.7	Output Isolation	Power and command returns isolated from chassis (can be connected)
3.5.8	Noise Immunity	13 dB minimum noise margin on decoder channels for unquieted noise
3.5.9	Telemetry Outputs	
3.5.9.1	Signal Strength	No RF: 0.50 ±0.25 Vdc -97.4 dBm: 0.25 Vdc above no RF reading -40.0 dBm: 4.75 ±0.20 Vdc
3.5.9.2	Tone Monitors	Monitors Tone Channel Status

	Present	Absent
Tone 1	" 1 "	" 0 "
Tone 2	" 1 "	" 0 "
Tone 3	" 1 "	" 0 "
Tone 4	" 1 "	" 0 "

Logic "1" = 3.5 ±1.5 Vdc
Logic "0" = 0.0 to 0.8 Vdc

3.6	POWER SUPPLY	
3.6.1	Supply Voltage	22 to 33 Vdc
3.6.2	Power Requirements	284 mA standby; 350 mA for command
3.6.3	Power Supply Isolation	Return isolated by from case
3.6.4	Turn-On Power Control for Receiver	None
3.6.5	Other Controls	None

3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461
3.7.2	Pulse Rejection	Not measured
3.7.3	AM Rejection	AM carriers will not cause command output
3.7.4	Image Rejection	60 dB minimum
3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-10°C to +71°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-65°C to +125°C
3.8.3	Humidity	95 percent
3.8.4	Altitude	Unlimited
3.8.5	Shock	60 g, 5 ms 25 kg peak pyro
3.8.6	Acceleration	40 g, each axis
3.8.7	Vibration	25.5 g rms, random
3.8.8	Acoustics	Not measured
3.8.9	Pressurization	Not measured
3.8.10	Operating Life	MTBF = 5,000 hours minimum
3.8.11	Shelf Life	5 years
3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	51-in^3
3.9.2	Dimensions	See Outline Drawing

3.9.3	Weight	2 pounds, 12 ounces maximum
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	RF Input (J1, J2): SMA J3: D38999/41YB5PN J4: D38999/41YB5PA J5: D38999/41YB35PN J6: D38999/41YB55PA

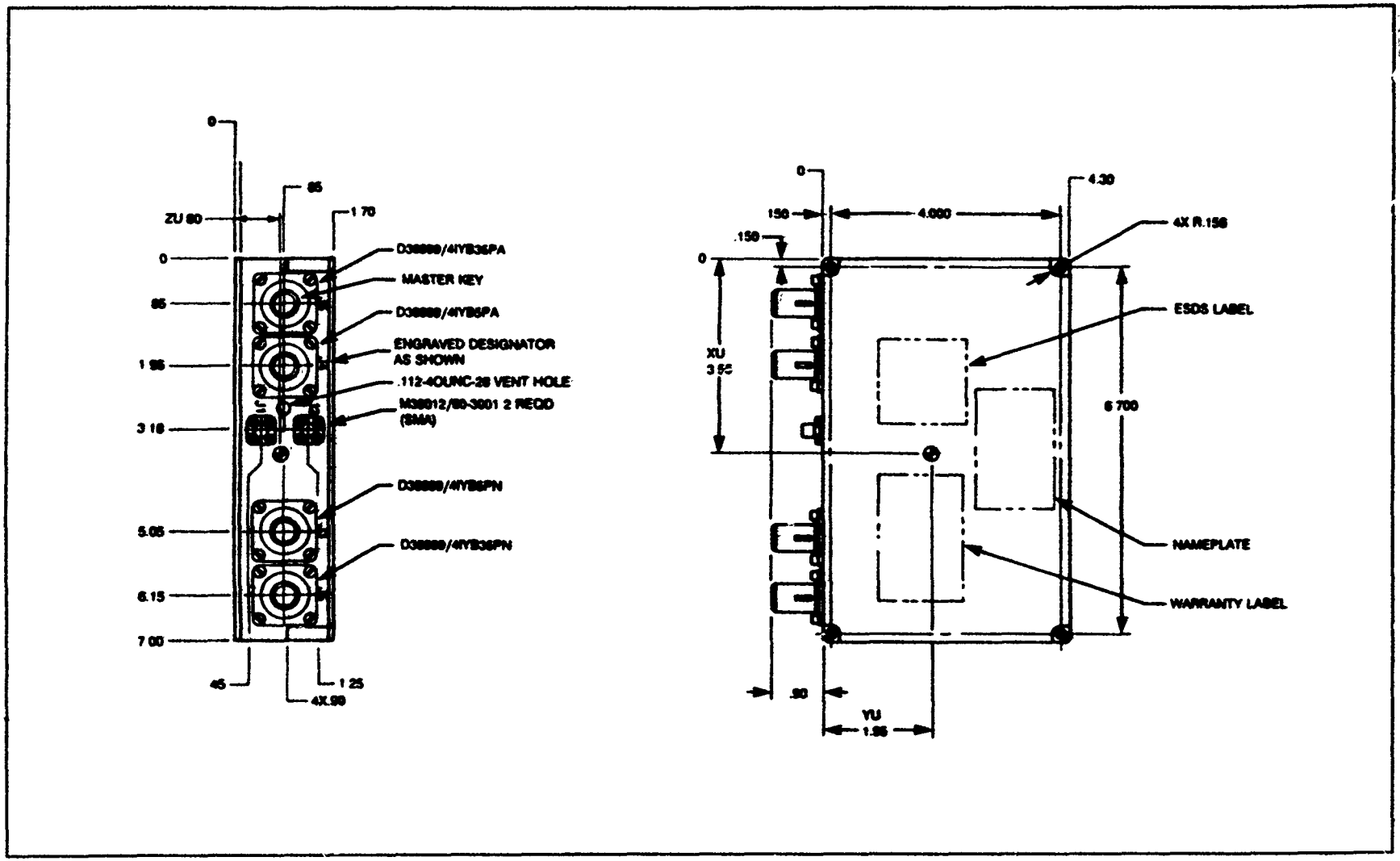


Figure 4-7. Outline drawing of LC Model FTR-575 Flight Termination Receiver.

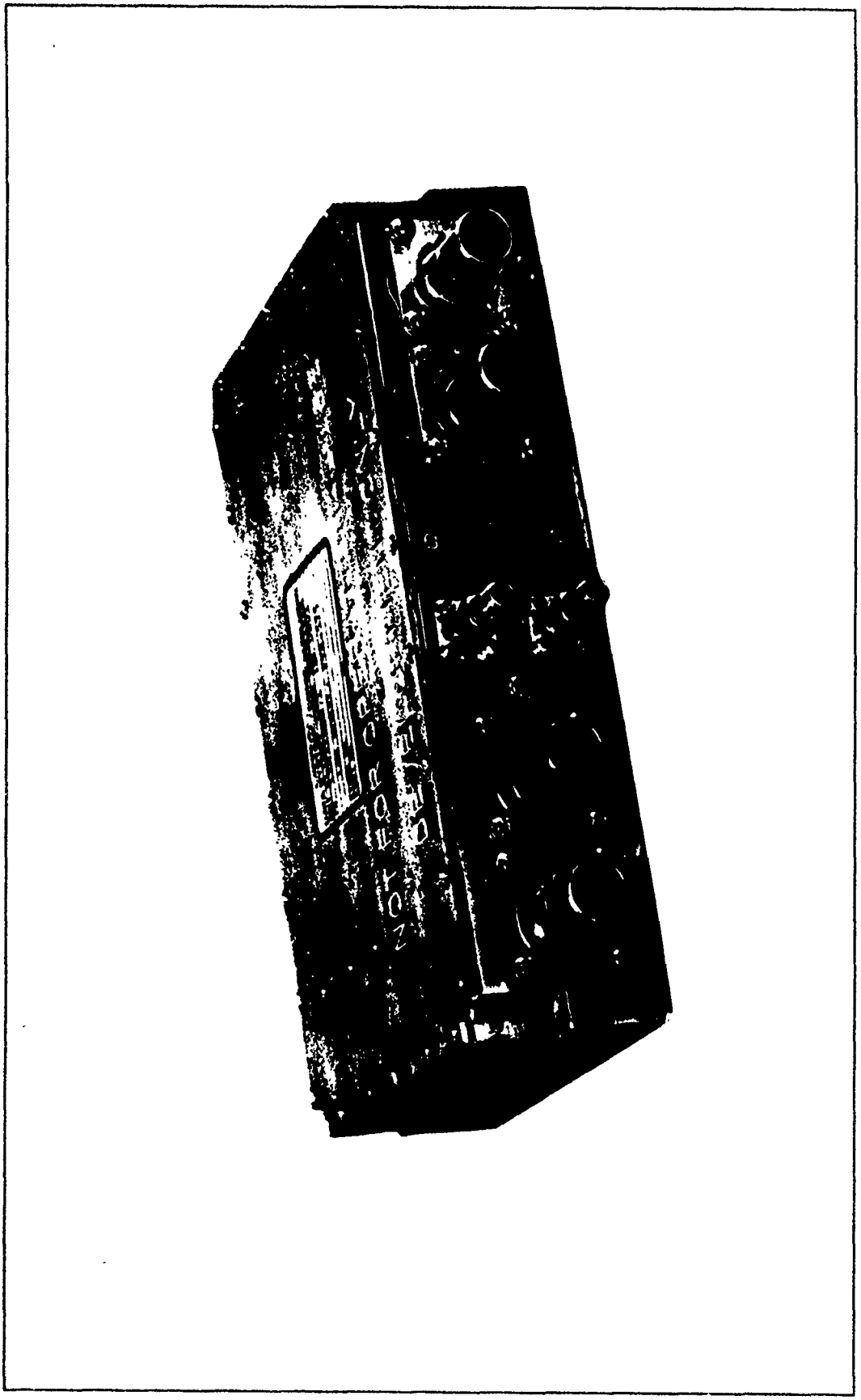


Figure 4-8. LC Model FTR-575 Flight Termination Receiver.

LORAL CONIC

FLIGHT TERMINATION RECEIVER

MODEL FTR-905

1. GENERAL DESCRIPTION

The Loral Conic Model FTR-905 Miniature Flight Termination Receiver is specifically designed for today's missiles range safety usage on programs with stringent environmental requirements requiring smaller and lightweight components. The FTR-905 accomplishes this be use of state-of-the-art hybrid technology. The FTR-905 accomplishes this by use of state-of-the-art hybrid technology. The FTR-905 represents a major breakthrough in miniaturization. The modular design of the unit lends itself well to other configurations and mounting provisions. The unit also features fail-safe circuits for both carrier and power.

2. BACKGROUND

The Model FTR-905 is being used on the AMRAAM program.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	406 to 550 MHz
3.1.2	Threshold Sensitivity (Command Output)	1 μV
3.1.3	Maximum Useable RF Input	1 Vrms
3.1.4	Operating Bandwidth	±45 kHz
3.1.5	Antenna Impedance	50 ohms (nominal)
3.1.6	VSWR	2:1 maximum
3.1.7	Local Oscillator Stability	±0.003 percent
3.1.8	Tuning Accuracy	±0.003 percent
3.1.9	Tuning Method	Fixed frequency, crystal-controlled

3.2	IF SECTION	
3.2.1	IF Frequency	24 MHz
3.2.2	Selectivity, 60 dB	±180 kHz maximum
3.2.3	Capture Ratio	<1 dB
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	500 Hz to 80 kHz
3.3.2	Audio Amplifier Distortion	<3 percent
3.3.3	Audio Output	N/A
3.3.4	Frequency Deviation	30 ±6 kHz peak per tone
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	3
3.4.2	Number of Simultaneous Useable Tones	3
3.4.3	Tone Channel Bandwidth	>1 percent at 2 dB
3.4.4	Adjacent Channel Rejection	34 dB
3.4.5	Decoder Threshold Deviation	15 kHz (nominal)
3.5	OUTPUT	
3.5.1	Types of Output	Solid-state
3.5.2	Output Current Capability	3 A
3.5.3	Output Leakage	50 µA maximum
3.5.4	Logic Circuit	Tone 2, Tone 3 = Optional, Monitor Tone 1, Tone 3 = Monitor, Arm Tone 1, Tone 3 OFF, Tone 2 = Destruct, Arm

3.5.5	Response Time for Commands	25 ms maximum
3.5.6	Transition Time Between Commands	<3 ms
3.5.7	Output Isolation	Power and command returns isolated to chassis (can be connected)
3.5.8	Noise Immunity	12 dB minimum noise margin on decoder channels for unquieted noise; removal of prime power enables fail-safe circuit; fail-safe circuit immune to EMI on power leads
3.5.9	Telemetry Outputs	
3.5.9.1	Signal Strength	No RF: 0.50 ±0.25 Vdc -101 dBm: 0.25 Vdc above no RF reading -41 dBm: 4.75 ±0.25 Vdc
3.5.9.2	Tone Monitors	Monitors Tone Channel Status

	Present	Absent
Tone 1	" 1 "	" 0 "
Tone 2	" 1 "	" 0 "
Tone 3	" 1 "	" 0 "
Tone 4	" 1 "	" 0 "

Logic "1" = Vcc ±3 Vdc
Logic "0" = 0.0 to 0.5 Vdc

3.6	POWER SUPPLY	
3.6.1	Supply Voltage	Command Power: 22 to 35 Vdc Receiver Power: 19 to 21 Vdc
3.6.2	Power Requirements	230 mA
3.6.3	Power Supply Isolation	Return isolated from case by 1 Mohm minimum
3.6.4	Turn-On Power Control for Receiver	None
3.6.5	Other Controls	Loss of carrier fail-safe (circuit can be enabled by using external transistor-transistor logic (TTL) level or internal level provided at connector)

3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461, CS04 limit 60 dB
3.7.2	Pulse Rejection	Immune to E-, G-, and I-Band at antenna port +27 dBm
3.7.3	AM Rejection	AM carriers will not cause command output
3.7.4	Image Rejection	60 dB minimum
3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-40°C to +85°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-65°C to +125°C
3.8.3	Humidity	97 percent
3.8.4	Altitude	100,000 feet minimum at -45°C
3.8.5	Shock	60 g, 5 ms
3.8.6	Acceleration	40 g, each axis
3.8.7	Vibration	10.28 g rms, random
3.8.8	Acoustics	Not measured
3.8.9	Pressurization	Not measured
3.8.10	Operating Life	MTBF = 5,000 hours minimum
3.8.11	Shelf Life	5 years
3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	3.7-in^3
3.9.2	Dimensions	See Outline Drawing

3.9.3	Weight	6.4 ounces
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	RF Input (J2): SMA Power, Command (J1): MDM-15S

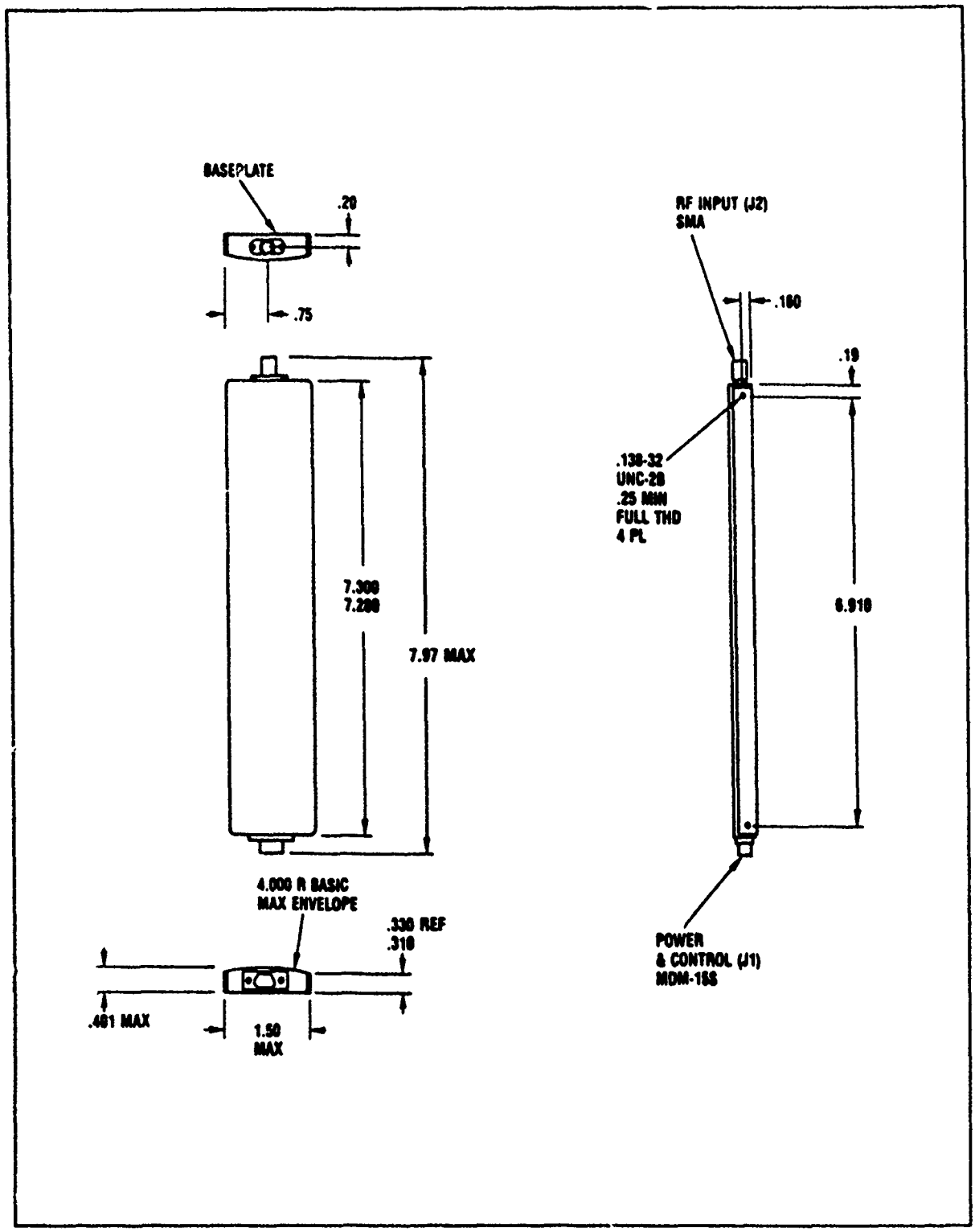


Figure 4-9. Outline drawing of LC Model FTR-905 Miniature Flight Termination Receiver.

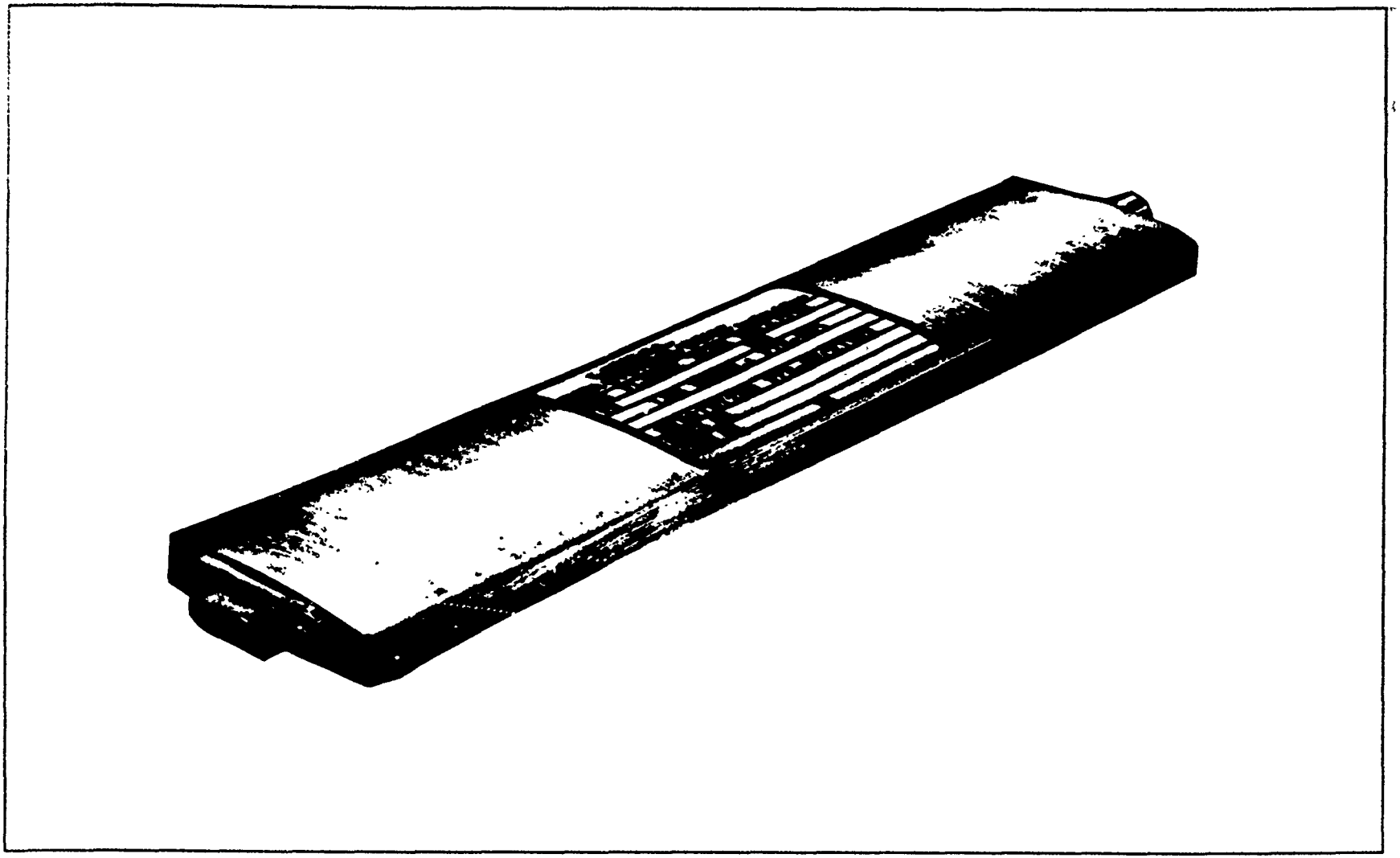


Figure 4-10. LC Model FTR-905 Miniature Flight Termination Receiver.

LORAL CONIC

FLIGHT TERMINATION RECEIVER

MODEL FTR-915

1. GENERAL DESCRIPTION

The Loral Conic Model FTR-915 Flight Termination Receiver is specifically designed for todays missile range safety usage on programs requiring smaller and lightweight components with stringent environmental requirements. The FTR-915 is a miniature, state-of-the-art Flight Termination Receiver/Decoder.

2. BACKGROUND

The Model FTR-915 uses modern hybrid technology and packaging techniques while retaining the highly reliable functional and environmental integrity of Loral designs is fully qualified.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	405 to 486 MHz
3.1.2	Threshold Sensitivity (Command Output)	2 μV
3.1.3	Maximum Useable RF Input	1 Vrms
3.1.4	Operating Bandwidth	±45 kHz
3.1.5	Antenna Impedance	50 ohms (nominal)
3.1.6	VSWR	2:1 maximum
3.1.7	Local Oscillator Stability	±0.005 percent
3.1.8	Tuning Accuracy	±0.005 percent
3.1.9	Tuning Method	Fixed frequency, crystal-controlled

3.2	IF SECTION (DUAL CONVERSION)	
3.2.1	IF Frequency	24 MHz
3.2.2	Selectivity, 60 dB	±180 kHz maximum ±375 kHz maximum/with audio
3.2.3	Capture Ratio	<1 dB
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	500 Hz to 20 kHz
3.3.2	Audio Amplifier Distortion	<3 percent
3.3.3	Audio Output	1 Vp-p at 10 kHz peak deviation
3.3.4	Frequency Deviation	30 ±6 kHz peak per tone
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	3
3.4.2	Number of Simultaneous Useable Tones	3
3.4.3	Tone Channel Bandwidth	>±1 percent at 2 dB
3.4.4	Adjacent Channel Rejection	80 dB
3.4.5	Decoder Threshold Deviation	15 kHz (nominal)
3.5	OUTPUT	
3.5.1	Types of Output	Solid-state
3.5.2	Output Current Capability	2 A; 7.5 A peak 10 ms
3.5.3	Output Leakage	50 μA

3.5.4	Logic Circuit	Tone 1, Tone 3 ON = Arm Tone 1 ON, Tone 3 OFF, Tone 2 ON = Destruct Other sequences available
3.5.5	Response Time for Commands	25 ms maximum
3.5.6	Transition Time Between Commands	<3 ms
3.5.7	Output Isolation	Power and command returns isolated from chassis (can be connected)
3.5.8	Noise Immunity	12 dB minimum noise margin on decoder channels for unquieted noise
3.5.9	Telemetry Outputs	
3.5.9.1	Signal Strength	No RF: 0.50 ±0.25 Vdc -101 dBm: 0.25 Vdc above no RF reading -30 dBm: 4.75 ±0.25 Vdc
3.5.9.2	Tone Monitors	Monitors Tone Channel Status

	Present	Absent
Tone 1	" 1 "	" 0 "
Tone 2	" 1 "	" 0 "
Tone 3	" 1 "	" 0 "

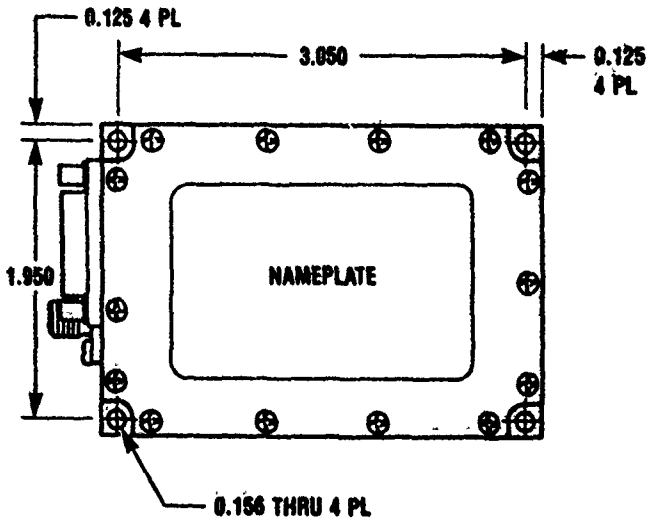
Logic "1" = Vcc ±3 Vdc
Logic "0" = 0.0 to 0.5 Vdc

3.6	POWER SUPPLY	
3.6.1	Supply Voltage	22 to 35 Vdc
3.6.2	Power Requirements	200 mA
3.6.3	Power Supply Isolation	Return isolated by from case
3.6.4	Turn-On Power Control for Receiver	None
3.6.5	Other Controls	N/A

3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461, CS04 A and B - 60 dB
3.7.2	Pulse Rejection	Immune to E-, G-, and I-Band applied to antenna port +27 dBm
3.7.3	AM Rejection	AM carriers will not cause command output
3.7.4	Image Rejection	60 dB minimum
3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-54°C to +85°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-65°C to +125°C
3.8.3	Humidity	97 percent
3.8.4	Altitude	250,000 feet minimum at -40°C
3.8.5	Shock	50 g, 11 ms half sine 20 g, 11 ms sawtooth 1,100 g, 0.5 ms pulse
3.8.6	Acceleration	100 g, each axis
3.8.7	Vibration	14.2 g rms, random
3.8.8	Acoustics	Not measured
3.8.9	Pressurization	30 lb/in^2, 30 minutes
3.8.10	Operating Life	MTBF = 8,500 hours minimum
3.8.11	Shelf Life	5 years

3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	5.5-in^3
3.9.2	Dimensions	See Outline Drawing
3.9.3	Weight	8 ounces
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	RF Input (J1): SMA Power, Command (J2): M83513/04-D11N

MODEL FTR-915 FLIGHT TERMINATION RECEIVER/DECODER



J1 – RF Input (SMA Jack)

J2 – Power & Commands (M83513)	
PIN	Function
1	+28 Vdc Power
2	No Connection
3	Power Return
4	Terminate Return
5	Monitor Return
6	Arm Return
7	No Connection
8	Terminate Command
9	No Connection
10	Optional Command
11	Auxiliary Audio/NC
12	Auxiliary Audio Return
13	Case Ground
14	+28 VDC Power
15	No Connection
16	Power Return
17	Terminate Return
18	Optional Return
19	No Connection
20	Terminate Command
21	No Connection
22	Monitor Command
23	Arm Command
24	Signal Strength
25	Signal Strength Return

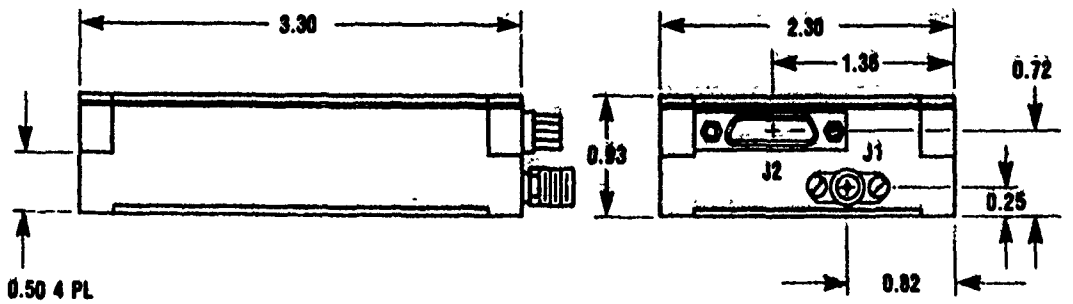


Figure 4-11. Outline drawing of LC Model FTR-915 Flight Termination Receiver.

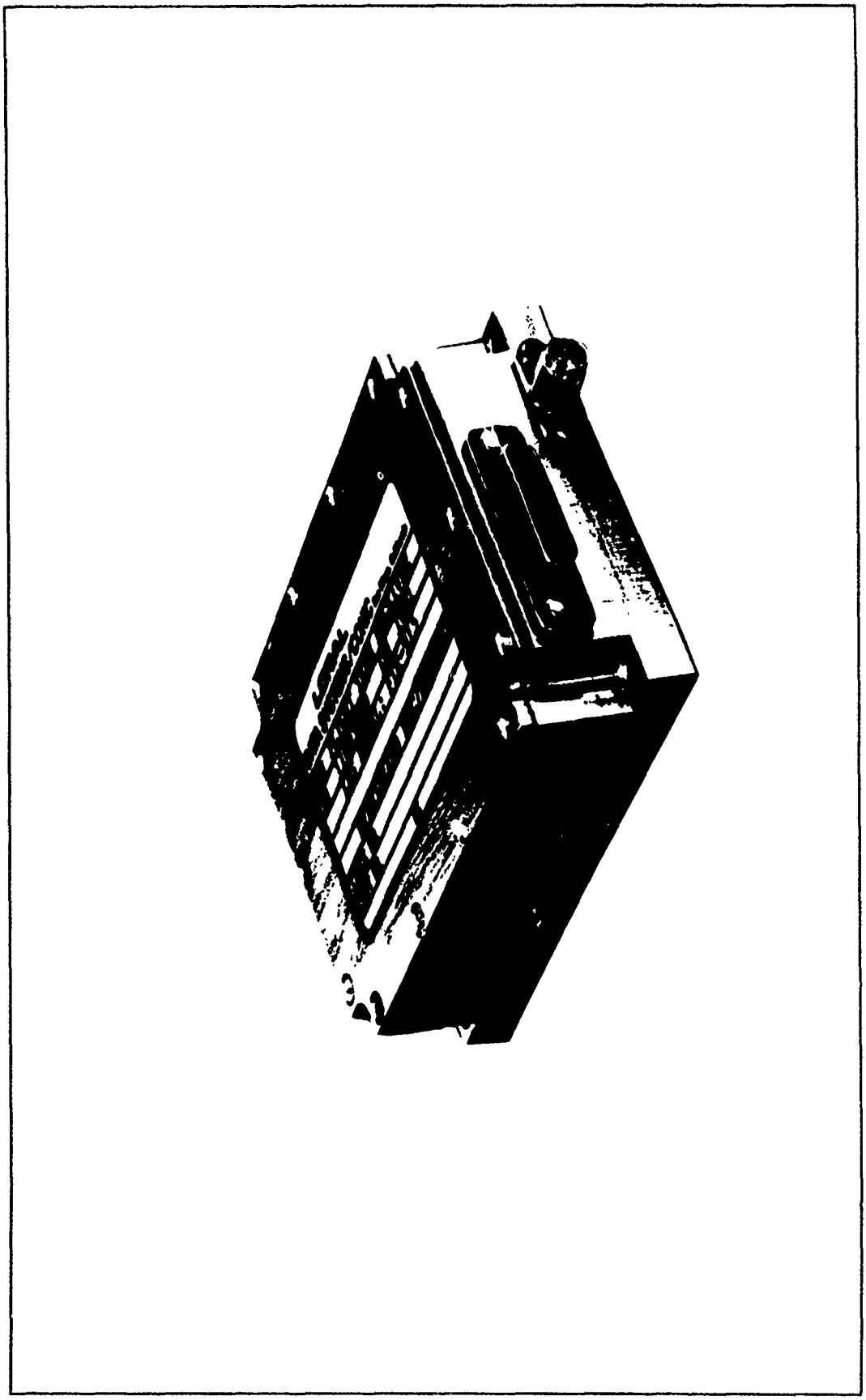


Figure 4-12. LC Model FTR-915 Flight Termination Receiver.

LORAL CONIC

FLIGHT TERMINATION RECEIVER

MODEL CCR-200

1. GENERAL DESCRIPTION

The Loral Conic Model CCR-200 series solid state FM command receiver/decoder is designed to meet the severe environmental and stringent reliability requirements of missiles and spacecraft. The unit is well suited, however, for other applications requiring ruggedized, lightweight miniature construction, high performance and/or high reliability and long trouble-free service life. The unit is available with three to 11 relay channels operating in IRIG command channels 1 through 20 with high adjacent subcarrier channel rejection and freedom from false triggering by white noise or power supply voltage transients.

2. BACKGROUND

The Model CCR-200 is used on special military program, foreign and domestic.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	220 to 550 MHz
3.1.2	Threshold Sensitivity (Command Output)	3 μV
3.1.3	Maximum Useable RF Input	2 Vrms
3.1.4	Operating Bandwidth	±20 kHz minimum
3.1.5	Antenna Impedance	50 ohms (nominal)
3.1.6	VSWR	2:1 maximum
3.1.7	Local Oscillator Stability	±0.005 percent
3.1.8	Tuning Accuracy	±0.005 percent
3.1.9	Tuning Method	Single frequency, crystal-controlled

3.2	IF SECTION (DUAL CONVERSION)	
3.2.1	IF Frequency	21.4 MHz
3.2.2	Selectivity, 60 dB	1.5 MHz maximum
3.2.3	Capture Ratio	<2 dB
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	300 Hz to 80 kHz
3.3.2	Audio Amplifier Distortion	<3 percent
3.3.3	Audio Output	30 mV rms per tone (12 ohm impedance)
3.3.4	Frequency Deviation	30 ±6 kHz
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	3 to 11 (optional)
3.4.2	Number of Simultaneous Useable Tones	3 (up to 6 by special request)
3.4.3	Tone Channel Bandwidth	±1 percent minimum at 2 dB
3.4.4	Adjacent Channel Rejection	34 dB minimum
3.4.5	Decoder Threshold Deviation	15 kHz (nominal)
3.5	OUTPUT	
3.5.1	Types of Output	Relay, 28 V (nominal)
3.5.2	Output Current Capability	2 A per command within 1 V of supply voltage
3.5.3	Output Leakage	None
3.5.4	Logic Circuitry	None (single output for each channel - all relay poles available at connector)

3.5.5	Response Time for Commands	<10 ms
3.5.6	Transition Time Between Commands	<5 ms
3.5.7	Output Isolation	1 Mohm
3.5.8	Noise Immunity	Relays will not operate on white noise or upon power "turn-on" and/or "turn-off"
3.5.9	Telemetry Outputs	Signal level indication, 0 to 4 Vdc (nominal) into 10 kohm load
3.6	POWER SUPPLY	
3.6.1	Supply Voltage	24 to 36 Vdc
3.6.2	Power Requirements	Standby: 150 mA to 400 mA (3 to 11 channels) Command: 32 mA per energized channel (700 mA maximum for 11 channels)
3.6.3	Power Supply Isolation	>1 Mohm from chassis
3.6.4	Turn-On Power Control for Receiver	N/A
3.6.5	Other Controls	N/A
3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461, except limits A and B; CS04 and CS08 are 60 dB
3.7.2	Pulse Rejection	Not measured
3.7.3	AM Rejection	Not measured
3.7.4	Image Rejection	60 dB minimum

3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-40°C to +70°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-55°C to +80°C
3.8.3	Humidity	95 percent
3.8.4	Altitude	Unlimited
3.8.5	Shock	50 g, 11 ms, 3 axes
3.8.6	Acceleration	100 g, 3 axes
3.8.7	Vibration	20 g sine, 20 to 2,000 Hz, 3 axes
3.8.8	Acoustics	Not measured
3.8.9	Pressurization	Not measured
3.8.10	Operating Life	MTBF = 1,200 hours minimum
3.8.11	Shelf Life	5 years
3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	See Outline Drawing
3.9.2	Dimensions	See Outline Drawing
3.9.3	Weight	44 ounces maximum (11 channels)
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	RF Input (J1): TNC (GRFF 4068-0015 Receiver Power and Signal: Cannon DEH-9P Decoder Power and Signal: Cannon DBH-25P (1 connector for 3 channels; 2 connectors for 4 to 11 channels)

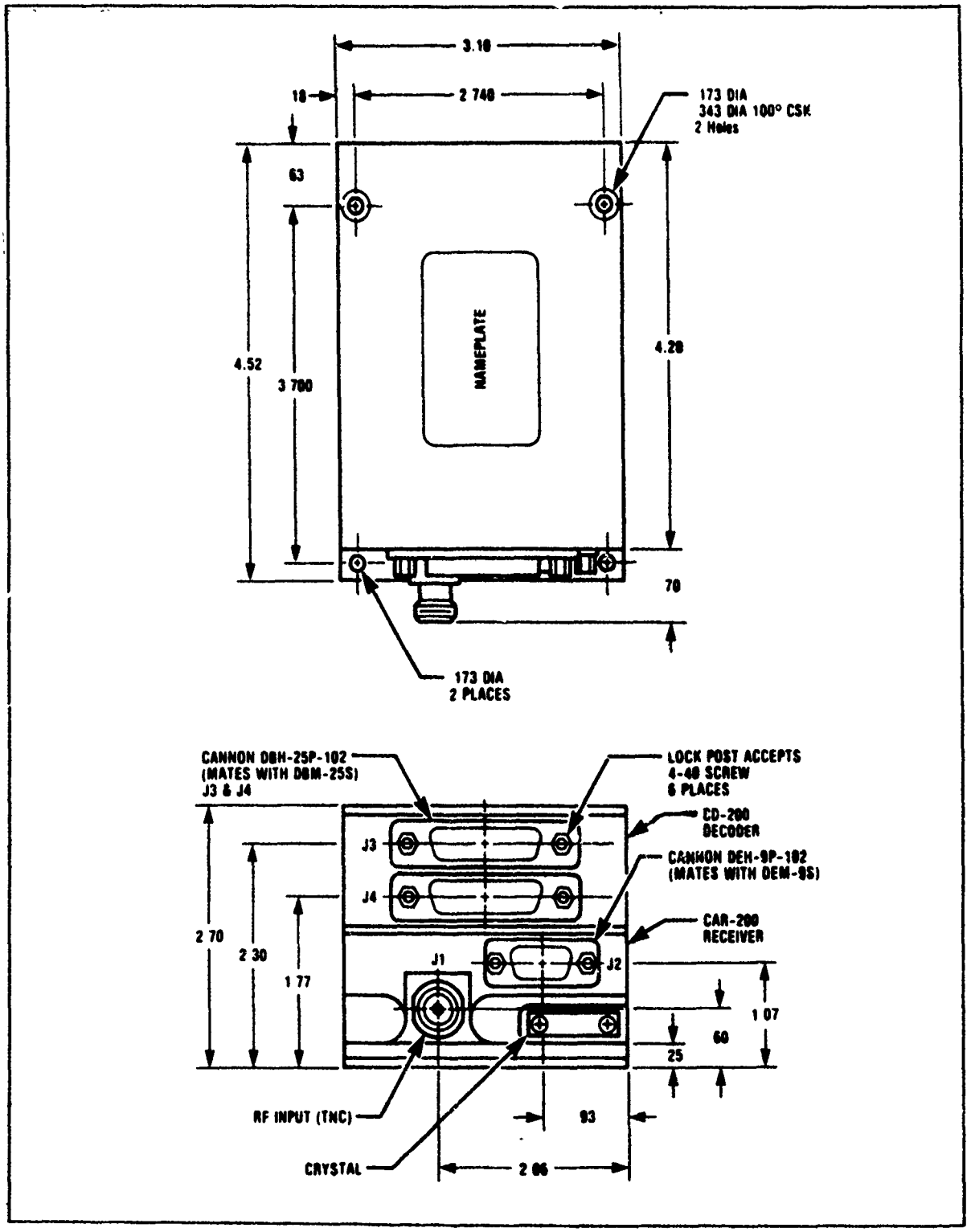


Figure 4-13. Outline drawing of LC Model CCR-200 Series Flight Termination Receiver.

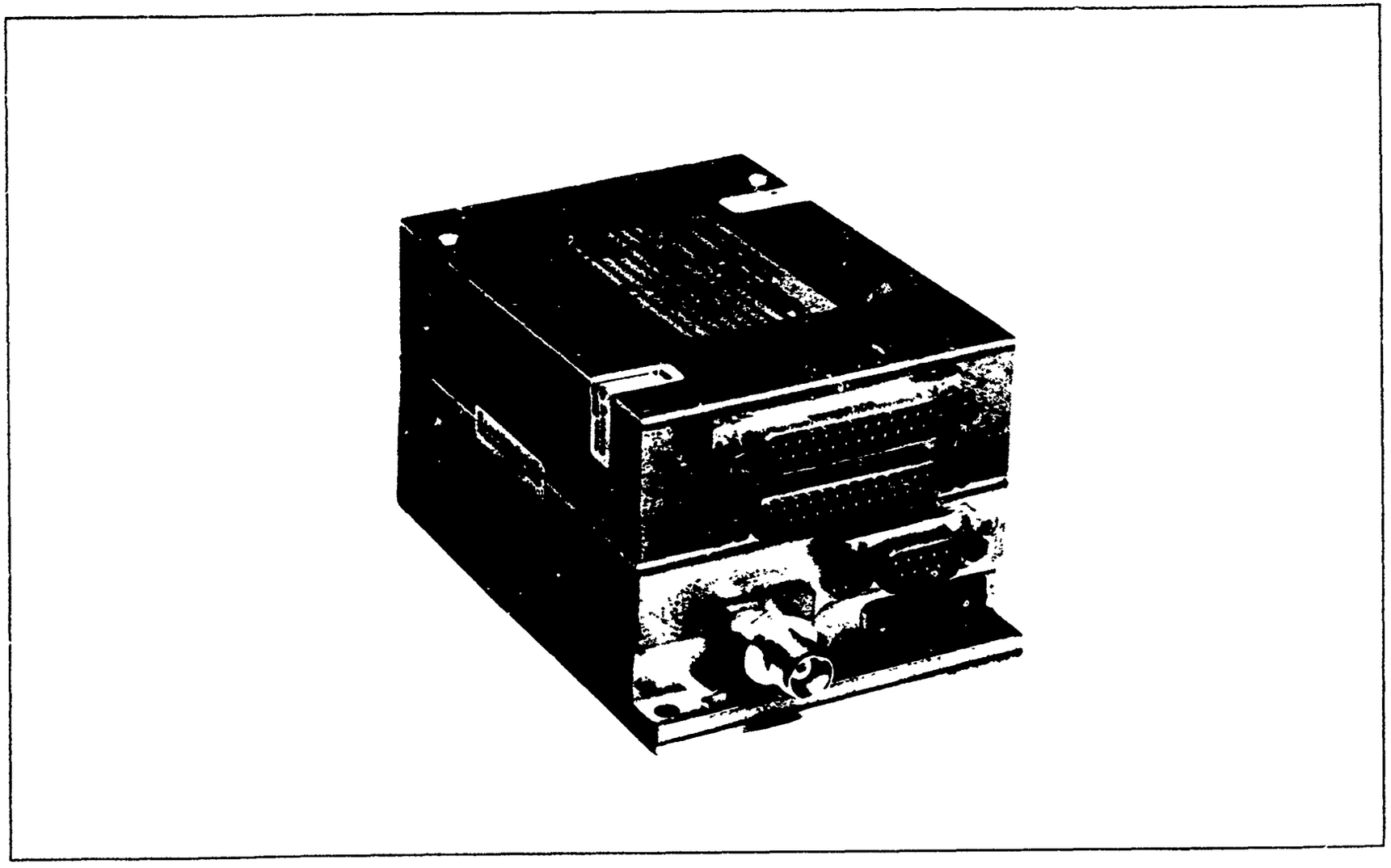


Figure 4-14. LC Model CCR-200 Series Command Receiver/Decoder.

LORAL CONIC

COMMAND DESTRUCT RECEIVER

*MODEL CDR-200

1. GENERAL DESCRIPTION

The Loral Conic Model CDR-200 series solid state FM Command Destruct Receiver is designed specifically for the stringent environmental requirements of airborne missile programs. All components are derated a minimum of 50 percent of the manufacturer's rated values to ensure a high degree of performance reliability.

The CDR-200 employs standard missile-range-required logic in the decoder sector to minimize the probability of a false destruct output due to unwanted RF radiation in the passband. The unit has successfully completed range qualification testing to IRMFSG 303-64. This unit has been replaced by Loral Model FTR-550 in form, fit and function that satisfies later range requirements.

2. BACKGROUND

The Model CDR-200 has been used with the following missiles: Tomahawk Cruise, Standard Arm, HARM, Condor, VTV, Sea Skimmer, and ALVRJ.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	400 to 475 MHz (single frequency, crystal-controlled)
3.1.2	Threshold Sensitivity (Command Output)	2 μV
3.1.3	Maximum Useable RF Input	2 Vrms
3.1.4	Operating Bandwidth	±45 kHz
3.1.5	Antenna Impedance	50 ohms (nominal)
3.1.6	VSWR	2:1 maximum

*Listed for reference only.

3.1.7	Local Oscillator Stability	±0.005 percent
3.1.8	Tuning Accuracy	±0.005 percent
3.1.9	Tuning Method	Fixed frequency, crystal-controlled
3.2	IF SECTION	
3.2.1	IF Frequency	21.4 MHz
3.2.2	Selectivity, 60 dB	700 kHz maximum
3.2.3	Capture Ratio	<2 dB
3.3	AUDIO SECTION*	
3.3.1	Audio Amplifier Response	300 Hz to 80 kHz, 3 dB
3.3.2	Audio Amplifier Distortion	<3 percent
3.3.3	Audio Output	25 mV peak per kHz
3.3.4	Frequency Deviation	30 ±6 kHz per tone
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	3
3.4.2	Number of Simultaneous Useable Tones	3
3.4.3	Tone Channel Bandwidth	±1 percent minimum at 2 dB
3.4.4	Adjacent Channel Rejection	34 dB
3.4.5	Decoder Threshold Deviation	12 kHz (nominal)

*Audio output available on -3 model only.

3.5	OUTPUT	
3.5.1	Types of Output	Relay, 28 V (nominal)
3.5.2	Output Current Capability	2 A per command within 1 V of supply voltage
3.5.3	Output Leakage	None
3.5.4	Logic Circuitry	1 and 5 = Arm 2 and 5 = Optional Command and Monitor 1 and 5, 5 OFF, 2 ON = Arm, Destruct 5 = Monitor 1, 2, 5 ON = Monitor, Arm, Optional
3.5.5	Response Time for Commands	<10 ms
3.5.6	Transition Time Between Commands	<3 ms
3.5.7	Output Isolation	1 Mohm
3.5.8	Noise Immunity	Interruption of primary power or RF power to receiver will not cause decoder relay closure
3.5.9	Telemetry Outputs	Signal level indication, 0 to 4 Vdc (nominal) into 10 kohm load
3.6	POWER SUPPLY	
3.6.1	Supply voltage	24 to 36 Vdc
3.6.2	Power Requirements	Standby: 100 mA Interrogate: 100 mA +38 mA per energized channel
3.6.3	Power Supply Isolation	>1 Mohm
3.6.4	Turn-On Power Control for Receiver	N/A
3.6.5	Other Controls	N/A

3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461, except limits A and B; CS04 and CS08 are 60 dB
3.7.2	Pulse Rejection	Not measured
3.7.3	AM Rejection	Not measured
3.7.4	Image Rejection	60 dB minimum
3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-40°C to +70°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-54°C to +100°C
3.8.3	Humidity	95 percent
3.8.4	Altitude	Unlimited
3.8.5	Shock	50 g, 11 ms, 3 axes
3.8.6	Acceleration	100 g, 3 axes
3.8.7	Vibration	20 g sine, 20 to 2,000 Hz, 3 axes
3.8.8	Acoustics	Not measured
3.8.9	Pressurization	Not measured
3.8.10	Operating Life	MTBF = 1,400 hours minimum
3.8.11	Shelf Life	8 years

3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	38-in^3
3.9.2	Dimensions	See Outline Drawing
3.9.3	Weight	34 ounces maximum
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	RF Input (J1): TNC Power: MS3112E-8-4P Arm: MS3112E-10-6S Destruct: MS3112E-8-4S

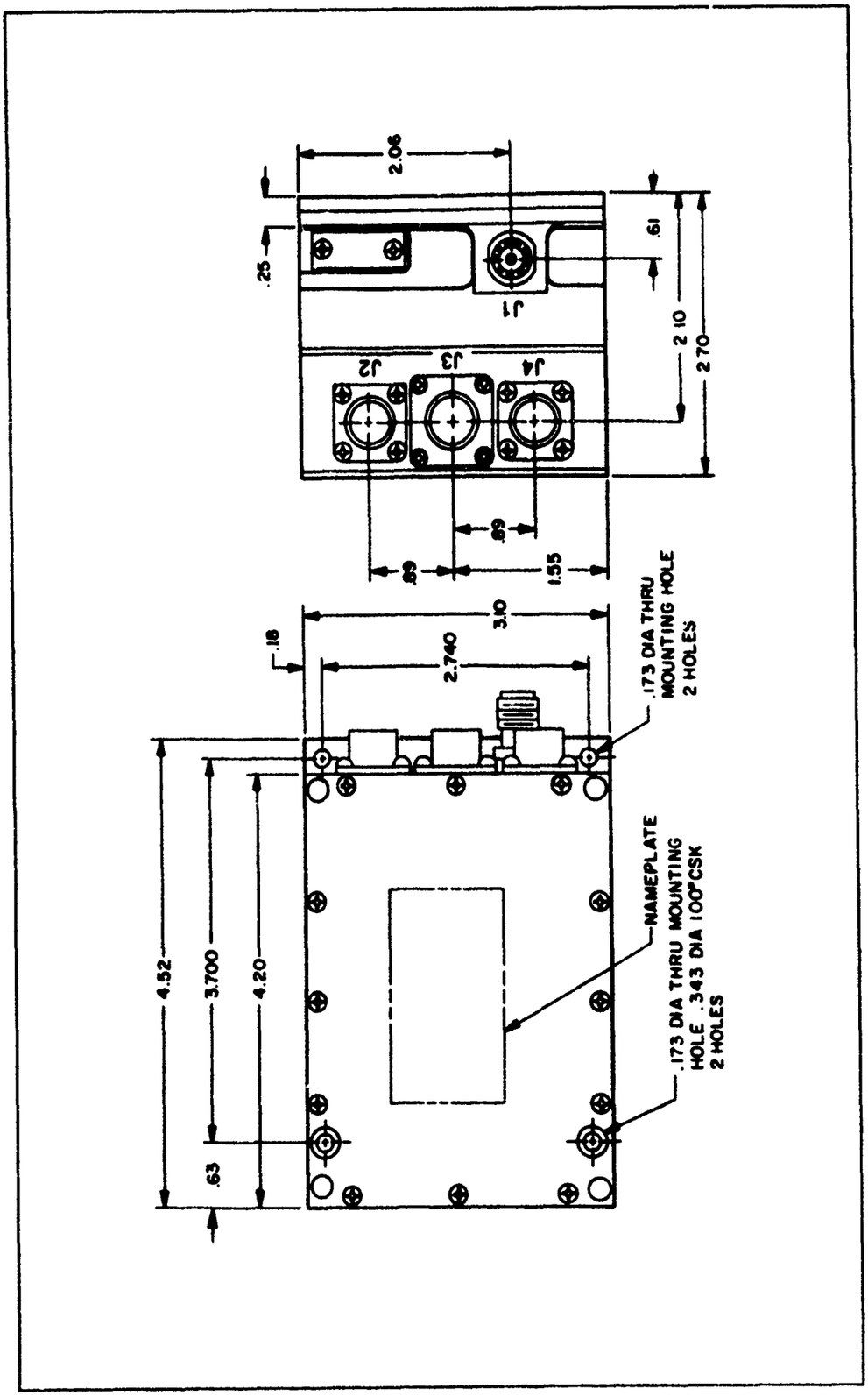


Figure 4-15. Outline drawing of LC Model CDR-200 Flight Termination Receiver.

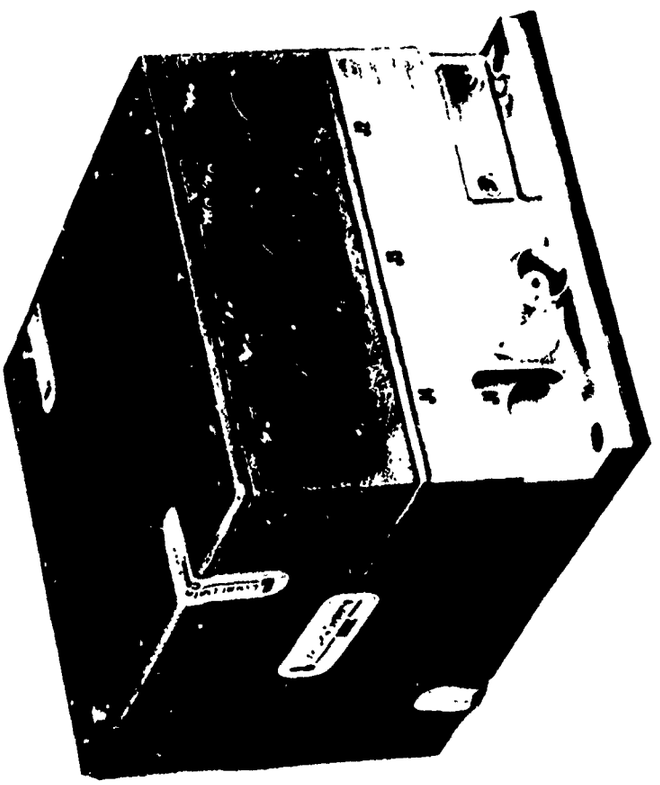


Figure 4-16. LC Model CDR-200 Command Destruct Receiver.

LORAL CONIC

COMMAND DESTRUCT RECEIVER

MODEL CDR-222

1. GENERAL DESCRIPTION

The Loral Conic Model CDR-222 Destruct Radio Frequency Unit (RFU) consists of a pair of redundant FM receivers and tone detectors, each supplied by either of two antenna connectors via a RF power divider/combiner. This unit is intended for use in range safety command systems to provide ground control of certain flight termination functions. The decoder logic is designed so that only one specific sequence of three tones will yield a destruct command output. The unit is designed for high-reliability applications, and all components are controlled by source control drawings. Phase-locked tone decoders and solid state output commands are featured in this unit.

2. BACKGROUND

The Model CDR-222 is being used with the Trident C-4. The units has been modified for the D5 Trident II program and is currently being manufactured in the new configuration.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	400 to 450 MHz
3.1.2	Threshold Sensitivity (Command Output)	1 μV
3.1.3	Maximum Useable RF Input	2 Vrms
3.1.4	Operating Bandwidth	±45 kHz
3.1.5	Antenna Impedance	50 ohms (nominal)
3.1.6	VSWR	2:1 maximum
3.1.7	Local Oscillator Stability	±0.005 percent
3.1.8	Tuning Accuracy	±0.005 percent
3.1.9	Tuning Method	Fixed frequency, crystal-controlled

3.2	IF SECTION (DUAL CONVERSION)	
3.2.1	IF Frequency	91.86 MHz 1st IF 10.7 MHz 2nd IF
3.2.2	Selectivity, 60 dB	±180 kHz maximum
3.2.3	Capture Ratio	<1 dB
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	5 Hz to 20 kHz, 3 dB
3.3.2	Audio Amplifier Distortion	<3 percent
3.3.3	Audio Output	N/A
3.3.4	Frequency Deviation	30 ±6 kHz per tone
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	3
3.4.2	Number of Simultaneous Useable Tones	3
3.4.3	Tone Channel Bandwidth	>±1 percent at 2 dB
3.4.4	Adjacent Channel Rejection	No level of adjacent channel deviation can activate desired channel
3.4.5	Decoder Threshold Deviation	16 kHz (nominal)
3.5	OUTPUT	
3.5.1	Types of Output	Solid-state
3.5.2	Output Current Capability	100 A maximum (destruct command) each
3.5.3	Output Leakage	<1 µA

*Audio output available on -3 model only.

3.5.4 Logic Circuitry (Sequential operation only)

Modulating Tone	Tone Output			Destruct RFU Logic Monitor*			Destruct RFU Logic Umbilical Monitor*			Destruct Command
	1	2	3	S	A	D	S	A	D	
None	-	-	-	+	-	-	+	-	-	-
1 Only	+	-	-	+	-	-	+	-	-	-
2 Only	-	+	-	+	-	-	+	-	-	-
5 Only	-	-	+	+	-	-	+	-	-	-
**Sequence:										
1 ON	+	-	-	+	-	-	+	-	-	-
2 ON	+	-	+	-	+	-	-	+	-	
5 OFF	+	-	-	-	+	-	-	+	-	-
2 ON	+	+	-	-	-	+	-	-	+	-

* Condition: SAFE, ARM, or DESTRUCT
** Tones must be applied in sequence to produce destruct command

3.5.5	Response Time for Commands	15 ms
3.5.6	Transition Time Between Commands	<5 ms
3.5.7	Output Isolation	1 Mohm
3.5.8	Noise Immunity	Interruption of primary power or RF power to receiver will not cause decoder output

3.5.9 Telemetry Outputs

3.5.9.1 Signal Strength

No RF: 0.50 ±0.25 Vdc
-101 dBm: 0.25 Vdc minimum above no RF reading
-53 dBm to +13 dBm: Positive increasing voltage to 4.75 ±0.25 Vdc

3.5.9.2 Logic and Umbilical Monitors

Logic		Umbilical	
Safe	*	Safe	2.0 Vdc
Arm	3.5 Vdc	Arm	10.0 Vdc
Destruct	4.5 Vdc	Destruct	18.0 Vdc

* Depending on tone channel assignments, the logic safe level varies (0.6, 1.2, 1.8, 2.4 Vdc).

3.5.9.3 Tone Output Monitors

Tones X, Y and Z outputs, 4.5 ±0.5 Vdc with 1 Kohm output impedance

3.6 POWER SUPPLY

3.6.1 Supply Voltage

24 to 36 Vdc

3.6.2 Power Requirements

Standby: <300 mA
Interrogate: <300 mA (no destruct load)

3.6.3 Power Supply Isolation

>1 Mohm from chassis

3.6.4 Turn-On Power Control for Receiver

N/A

3.6.5 Other Controls

N/A

3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461, CS04 limits A and B, 60 dB
3.7.2	Pulse Rejection	Not susceptible to pulse radar interference
3.7.3	AM Rejection	Tone channels will not respond to carrier's sinewave modulated at 95 percent for input levels of -110 ohms to -47 dBm
3.7.4	Image Rejection	60 dB minimum
3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-40°C to +70°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-55°C to +100°C
3.8.3	Humidity	95 percent
3.8.4	Altitude	Unlimited
3.8.5	Shock	50 g, 11 ms
3.8.6	Acceleration	100 g, 3 axes
3.8.7	Vibration	20 g sine, 20 to 2,000 Hz, 3 axes; random, 9 g rms
3.8.8	Acoustics	N/A
3.8.9	Pressurization	75 psi, high pressure; 0.17 mm Hg, low pressure
3.8.10	Operating Life	MTBF = 1,600 hours minimum
3.8.11	Shelf Life	8 years

3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	94-in^3
3.9.2	Dimensions	See Outline Drawing
3.9.3	Weigh'	5 pounds maximum
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	See Outline Drawing

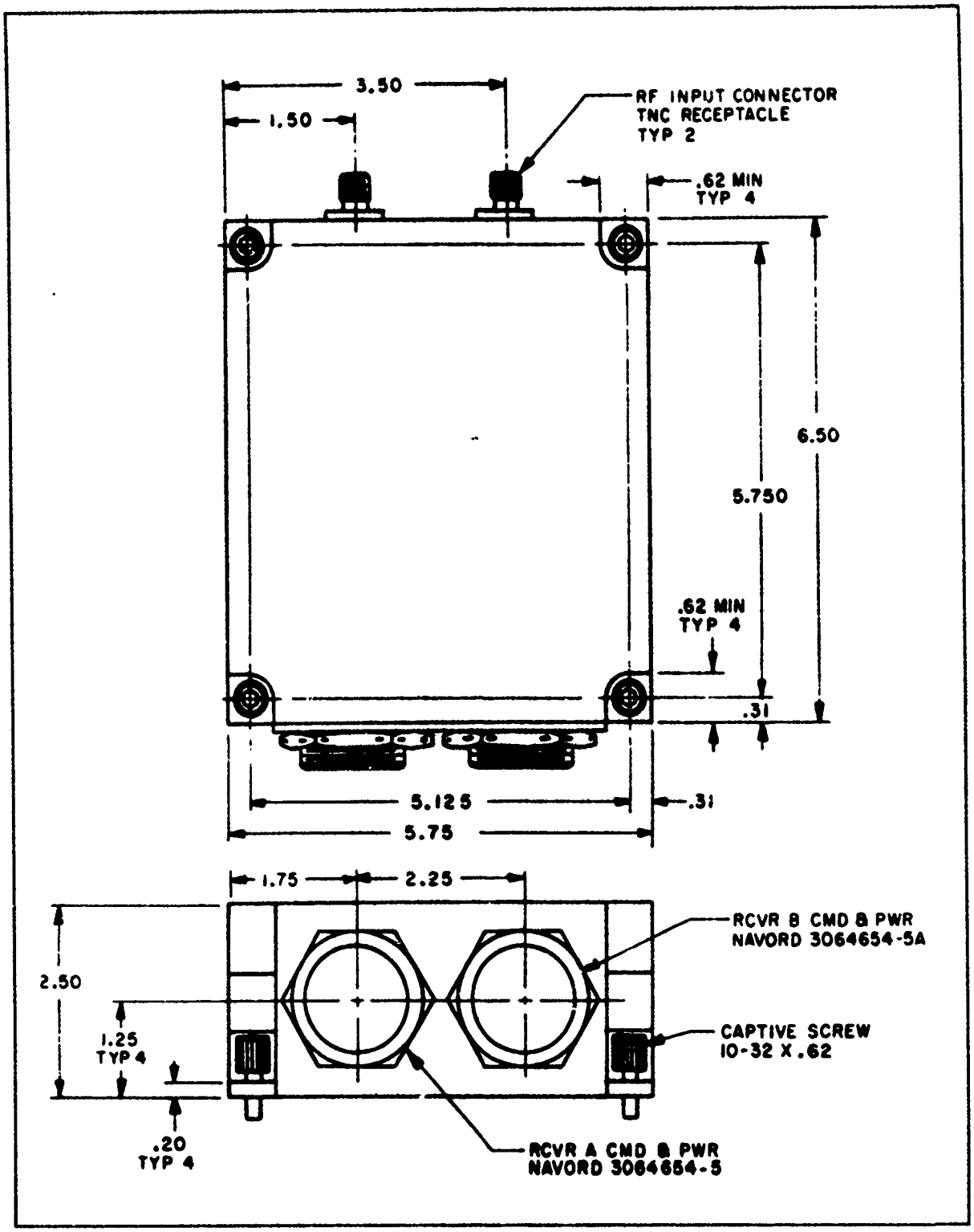


Figure 4-17. Outline drawing of LC Model CDR-222 Flight Termination Receiver.

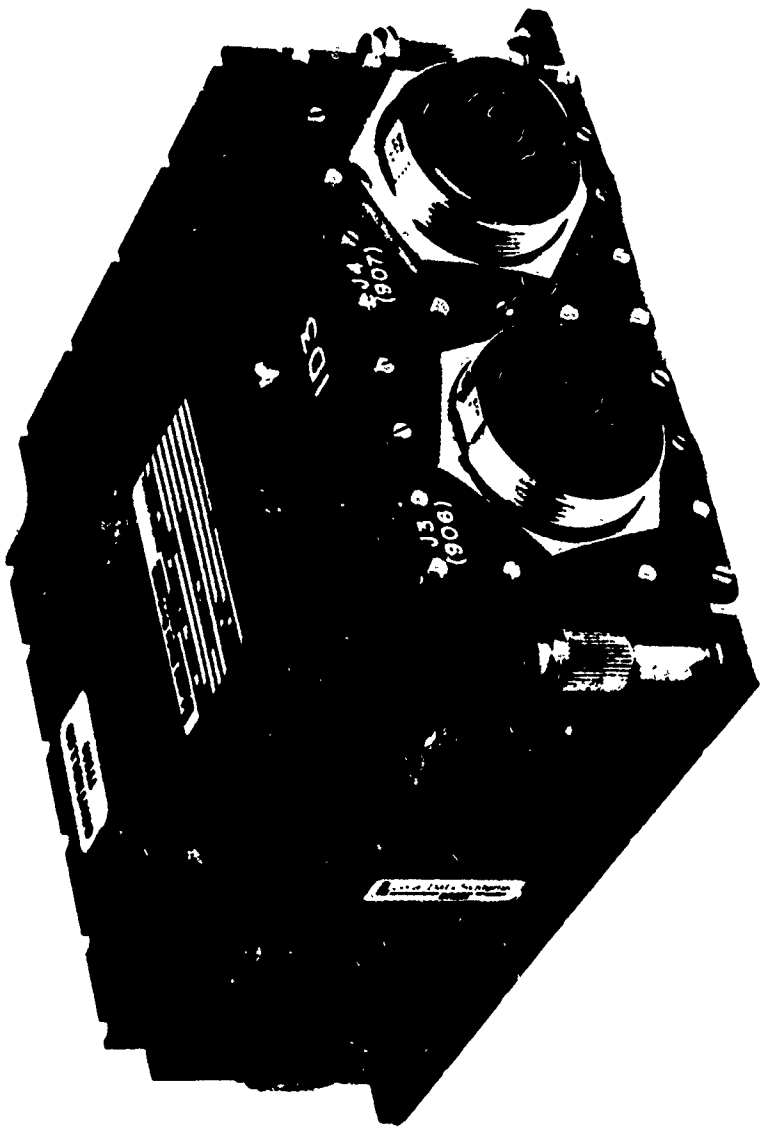


Figure 4-18. LC Model CDR-222 Command Destruct Receiver.

LORAL CONIC

COMMAND DESTRUCT RECEIVER

MODEL CDR-555

1. GENERAL DESCRIPTION

The Loral Conic Model CDR-555 contains two receiver/destruct decoders and a control decoder integrated as a system. The unit thus provides redundancy for range safety. Two versions of the standard CDR-555 are available. The standard -1 version contains an 8-channel control decoder with a 5-bit word output, while the -2 versions features a 6-channel decoder with a 4-bit word output.

Each receiver has an antenna input and a three-channel tone decoder providing four coded command outputs. The control decoder section of the unit selects and decodes the audio signal from each receiver and outputs the parallel word. A validity bit and a carrier presence bit are provided for system status. The decoder responds to two-and-only-two simultaneous tones, yielding 28 combinations of 5-bit data for the -1 version and 15 combinations of 4-bit data for the -2.

The Model CDR-555 is well suited for high-reliability applications where ruggedized, lightweight, miniature construction and high performance are required.

2. BACKGROUND

The Model CDR-555 has been used with the Air Launched Cruise Missile, the Tomahawk, and other cruise missiles.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	405 to 486 MHz
3.1.2	Threshold Sensitivity (Command Output)	2 μV
3.1.3	Maximum Useable RF Input	2 Vrms
3.1.4	Operating Bandwidth	±45 kHz

3.1.5	Antenna Impedance	50 ohms (nominal)
3.1.6	VSWR	2:1 maximum
3.1.7	Local Oscillator Stability	±0.005 percent
3.1.8	Tuning Accuracy	±0.005 percent
3.1.9	Tuning Method	Fixed frequency, crystal-controlled
3.2	IF SECTION	
3.2.1	IF Frequency	10.7 MHz
3.2.2	Selectivity, 60 dB	±350 kHz maximum
3.2.3	Capture Ratio	<1 dB
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	500 Hz to 100 kHz, 1 dB
3.3.2	Audio Amplifier Distortion	<3 percent
3.3.3	Audio Output	35 mVp-p per kHz peak
3.3.4	Frequency Deviation	30 ±6 kHz per tone
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	
	Each Range Safety Receiver:	3
	Control Decoder: (Any two tones produce 5- or 4-bit word)	8 or 6 channels

3.4.2	Number of Simultaneous Useable Tones	
	Each Range Safety Receiver:	3 tones
	Control Decoder: (Range safety receiver commands will not be interfered with by simultaneous tones applied to control decoder)	2 tones
3.4.3	Tone Channel Bandwidth	All decoders, ±1 percent at 2 dB
3.4.4	Adjacent Channel Rejection	34 dB
3.4.5	Decoder Threshold Deviation	30 ±6 kHz peak per tone
3.5	OUTPUT	
3.5.1	Types of Output	
	Range Safety Receivers:	Relays, 28 V (nominal)
	Control Decoder (Word Validity, Loss of RF):	Solid-state, TTL differential
3.5.2	Output Current Capability	
	Range Safety Receivers:	2 A continuous within 1 V of supply
	Control Decoder (Word Validity, Loss of RF):	Designed to drive differential input line receivers
3.5.3	Output Leakage	
	Range Safety Receivers:	None
	Control Decoder:	1 µA maximum

3.5.4 Logic Circuitry

Range Safety Receiver:

1, 5 ON = Monitor, Arm
2, 5 ON = Monitor, Optional
1, 5 ON, 5 OFF, 2 ON = Monitor, Arm, Destruct
5 ON = Monitor

Control Decoder:

OUTPUT CODE FORMAT (-1)

TONE PAIR	DATA WORD					VALIDITY BIT	CARRIER PRESENCE
	2^0	2^1	2^2	2^3	2^4		
Carrier Threshold	1	1	1	1	1	0	0
Carrier - 101 dBm	1	1	1	1	1	0	0
6,8	1	0	0	0	0	1	1
6,12	0	1	0	0	0	1	1
6,14	1	1	0	0	0	1	1
14,15	0	0	1	0	0	1	1
7,8	1	0	1	0	0	1	1
7,12	0	1	1	0	0	1	1
8,14	1	1	1	0	0	1	1
13,15	0	0	0	1	0	1	1
8,12	0	1	0	1	0	1	1
8,14	1	1	0	1	0	1	1
12,15	0	0	1	1	0	1	1
12,13	1	0	1	1	0	1	1
11,12	0	1	1	1	0	1	1
11,14	1	1	1	1	0	1	1
6,7	0	0	0	0	1	1	1
6,11	1	0	0	0	1	1	1
6,13	0	1	0	0	1	1	1
6,15	1	1	0	0	1	1	1
7,11	1	0	1	0	1	1	1
7,13	0	1	1	0	1	1	1
7,15	1	1	1	0	1	1	1
13,14	0	0	0	1	1	1	1
8,11	1	0	0	1	1	1	1
8,13	0	1	0	1	1	1	1
8,15	1	1	0	1	1	1	1
12,14	0	0	1	1	1	1	1
11,13	0	1	1	1	1	1	1
11,15	1	1	1	1	1	1	1

3.5.5	Response Time for Commands	
	Range Safety Receivers:	20 ms maximum
	Control Decoder:	25 ms maximum
3.5.6	Transition Time Between Commands	
	Range Safety Receivers:	<3 ms
	Control Decoder:	<10 ms
3.5.7	Output Isolation	
	Range Safety Receivers:	>1 Mohm from chassis
	Control Decoder:	>1 Mohm from chassis and power return
3.5.8	Noise Immunity	>12 dB for decoder channels on unquieted noise (interruption of primary power or RF power to unit will not cause relay closure)
3.5.9	Telemetry Outputs	

With no RF input, the quiescent level is a nominal 0.50 ±0.25 V, increasing to a value not to exceed 4.75 ±0.25 V at an RF level of -40 dBm. The slope is positive and does not change direction over the RF signal dynamic range.

3.6	POWER SUPPLY	
3.6.1	Supply Voltage	23 to 34 Vdc, all sections
3.6.2	Power Requirements	
	Range Safety Receiver:	180 mA standby, 300 mA command
	Control Decoder:	500 mA maximum
3.6.3	Power Supply Isolation	>1 Mohm from chassis
3.6.4	Turn-On Power Control for Receiver	N/A
3.6.5	Other Controls	N/A

3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461, CS04 and CS08 limits A and B are 60 dB
3.7.2	Pulse Rejection	Not measured
3.7.3	AM Rejection	AM carrier will not produce command or control outputs
3.7.4	Image Rejection	60 dB minimum
3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-54°C to +80°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-54°C to +125°C
3.8.3	Humidity	95 percent
3.8.4	Altitude	Unlimited
3.8.5	Shock	50 g, 11 ms
3.8.6	Acceleration	100 g
3.8.7	Vibration	10 g rms
3.8.8	Acoustics	Not measured
3.8.9	Pressurization	Not measured
3.8.10	Operating Life	MTBF = 5,000 hours minimum
3.8.11	Shelf Life	10 years

3.9 PHYSICAL CHARACTERISTICS

3.9.1	Volume	53-in^3
3.9.2	Dimensions	See Outline Drawing
3.9.3	Weight	50 ounces maximum
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	

RF Input (J1):	SMA Receptacle, Receiver A
Command (J2):	MS27476Y 10E98P, Receiver A
Power (J3):	MS27476Y 10E98PA, Receiver A
RF Input (J4):	SMA Receptacle, Receiver B
Command (J5):	MS27476T 10E98P, Receiver B
Power (J6):	MS27476Y 10E98PA, Receiver B
All Functions (J7):	M24308/9-3 (modified) Decoder

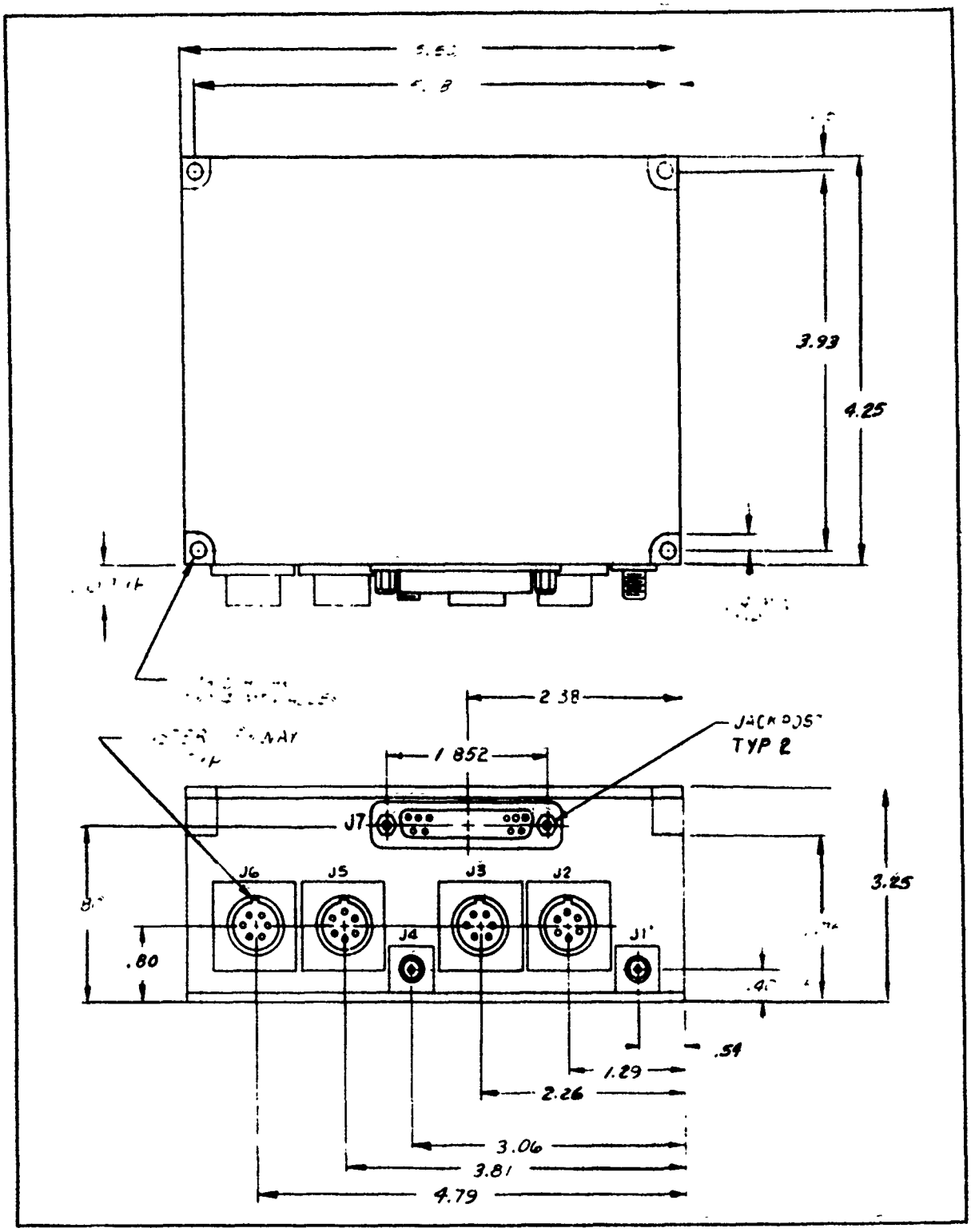


Figure 4-19. Outline drawing of LC Model CDR-555 Flight Termination Receiver.

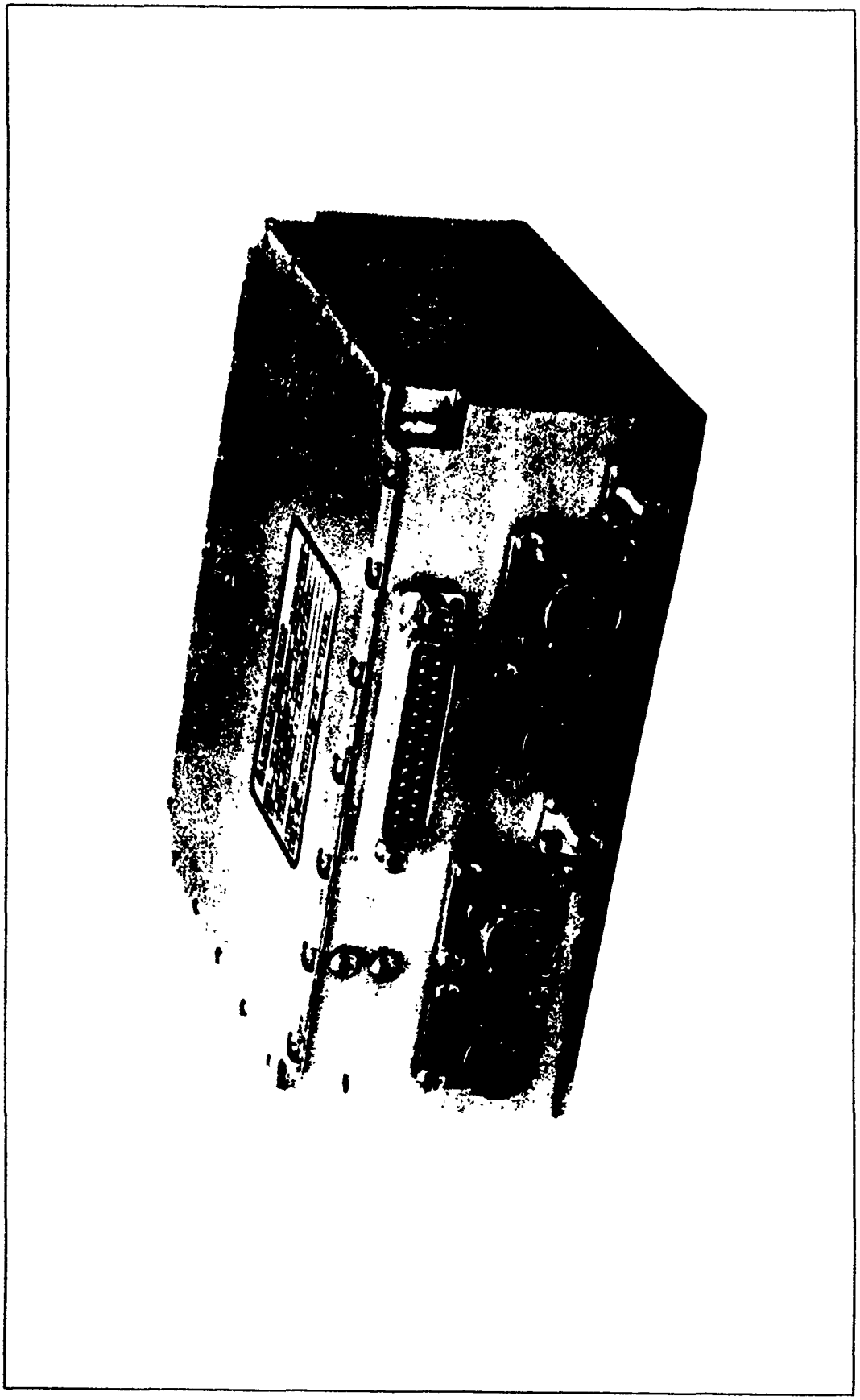


Figure 4-20. LC Model CDR-555 Command Receiver/Control Decoder.

5. SERVO CORPORATION OF AMERICA
111 New South Road
Hicksville, New York 11802
(Phone: 516-938-9700)

FLIGHT TERMINATION RECEIVERS

Model 505000

SERVO CORPORATION OF AMERICA

FLIGHT TERMINATION RECEIVER

MODEL 505000

1. GENERAL DESCRIPTION

The Servo Model 505000 Flight Termination Receiver has been assigned the nomenclature R-2449(V)/DRW and is compliant with NAVAIR Drawing 642AS8859. It is built to all weapons specification construction requirements of both WS-6535 and MIL-STD-2000.

The receiver is intended for range safety functions in unmanned vehicles, operating in extreme environments, each unit is subjected to burn-in, shock, vibration and extended term extreme temperature testing. Operation has been demonstrated with humidity, pressures corresponding to 100,000 feet altitude down to two atmospheres, and over a full spectrum of electromagnetic compatibility requirements.

To assure the utmost in reliability, the terminate output cannot be unintentionally activated through the failure of any one component.

2. BACKGROUND

The Model 505000 was originally procured for use on the VANDAL U.A.V and was qualified in 1989.

3. TECHNICAL SPECIFICATIONS

3.1 RF SECTION

3.1.1	Frequency Range (Tuneable)	406 to 450 MHz
3.1.2	Threshold Sensitivity (Command Output)	2 µV rms
3.1.3	Maximum Useable RF Input	0.02 Vrms
3.1.4	Operating Bandwidth	±45 kHz
3.1.5	Antenna Impedance	50 ohms (nominal)
3.1.6	VSWR	<2:1
3.1.7	Passband Center Frequency	within ±0.005 percent

3.2	IF SECTION	
3.2.1	IF Frequency	10.7 MHz
3.2.2	Selectivity, 60 dB	±180 kHz maximum
3.3	DECODER SECTION	
3.3.1	Number of Decoder Channels	3
3.3.2	Number of Simultaneous Useable Tones	3
3.3.3	Tone Channel Bandwidth	±1 percent minimum, ±4 percent maximum
3.3.4	Deviation	30 ±3 kHz nominal
3.4	OUTPUT	
3.4.1	Command Outputs:	
3.4.1.1	Output Type	Solid-state (28 V)
3.4.1.2	Output Current Capability	1.2 A
3.4.1.3	Output Leakage	1 μA
3.4.1.4	Output Logic Sequence	1, 5 ON = Monitor & Arm 1 ON = Arm 2, 5 ON = Arm & Terminate
3.4.1.5	Output Response Delay	25 ms maximum; 10 ms typical
3.4.1.6	Output Isolation	1 Mohm minimum
3.4.2	Auxiliary Outputs:	
3.4.2.1	Signal Level, no signal	0.50 ±0.25 Vdc
3.4.2.2	Signal Level, maximum signal	4.25 to 5.00 Vdc

3.5	POWER SUPPLY	
3.5.1	Supply Voltage	24 to 36 Vdc
3.5.2	Current drain, no signal	190 mA maximum
3.5.3	Current drain, all commands	300 mA maximum
3.5.4	Power Supply Isolation	1 Mohm, minimum
3.6	ELECTROMAGNETIC INTERFERENCE	
3.6.1	RFI Suppression	
3.6.1.1	MIL-STD-461B Tests:	CE01, CE03, CE06, RE02, RS02, RS03, CS01-CS06
3.6.1.2	MIL-STD-1399 Tests:	Section 401
3.6.2	Telemetry Signal Rejection	2.2 to 2.3 GHz at +10 dBm
3.6.3	Pulse Rejection	5.4 to 5.9 GHz at +27 dBm 9.0 to 9.5 GHz at +27 dBm
3.7	ENVIRONMENTAL CHARACTERISTICS	
3.7.1	Operating Temperature Range	-55°C to +76°C
3.7.2	Humidity	MIL-STD-810, Method 507.1
3.7.3	Altitude	100,000 feet
3.7.4	Shock	1,100 g, 0.5 ms
3.7.5	Vibration	16 g rms, random
	Random: Sinusoidal:	0.06g^2/Hz 15 g rms
3.7.6	Pressurization	To 30 psia.

3.8	PHYSICAL CHARACTERISTICS	
3.8.1	Dimensions	See Outline Drawing
3.8.2	Weight	25 ounces
3.8.3	Mounting Attitude	Any
3.8.4	External Adjustments	None

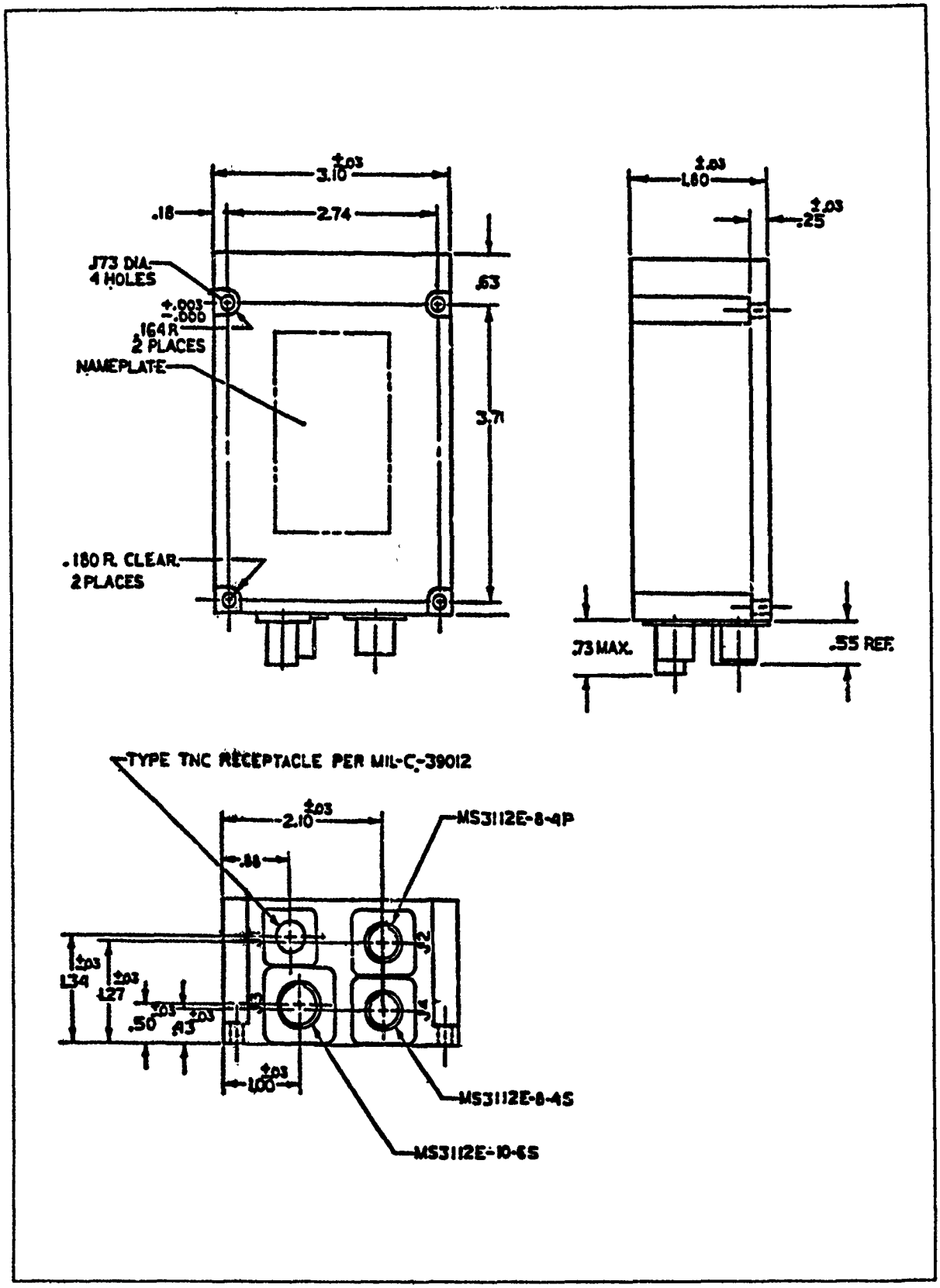


Figure 5-1. Servo Corporation Model 505000 Flight Termination Receiver.

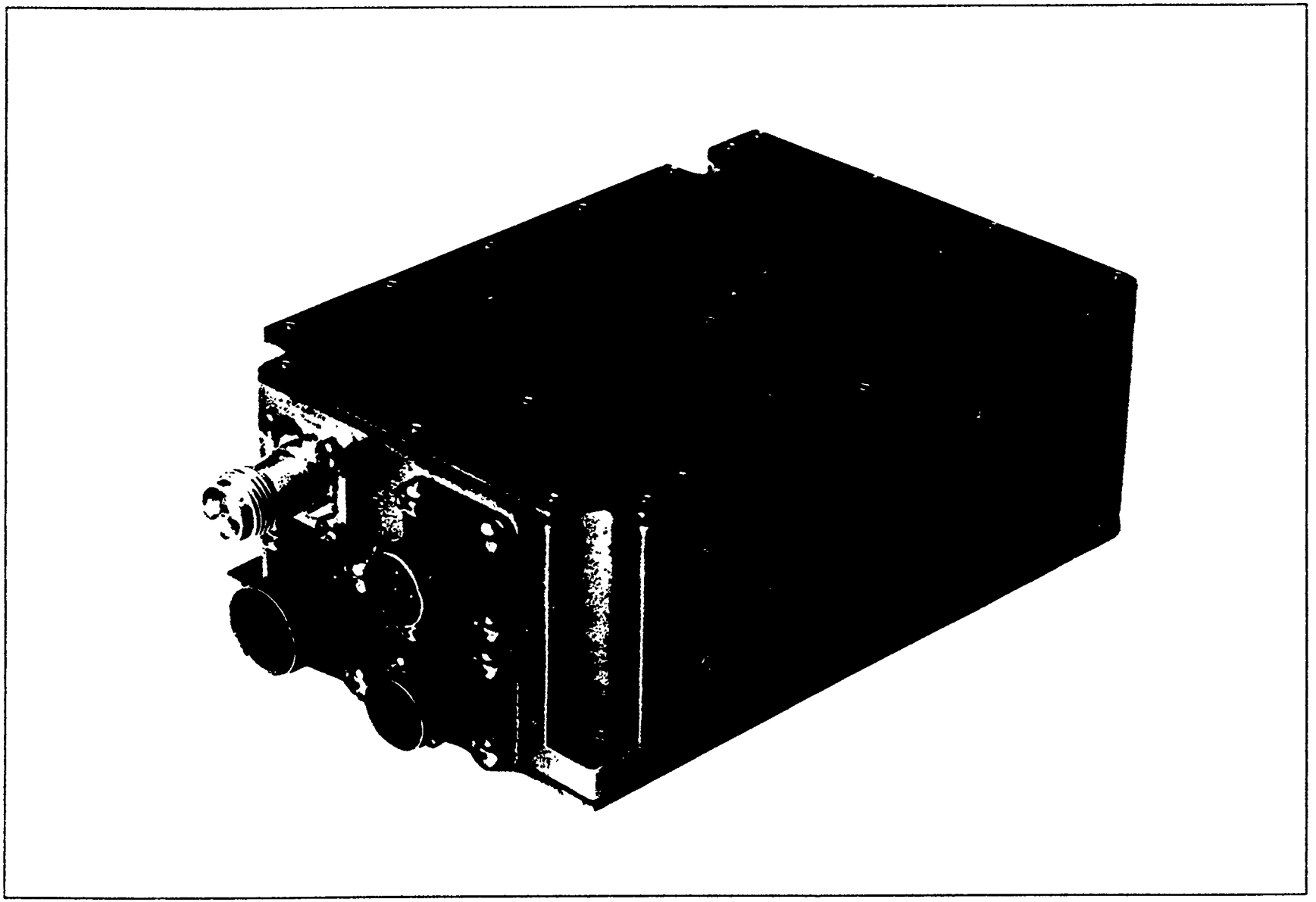


Figure 5-2. Servo Model 505000 Flight Termination Receiver.

6. HERLEY INDUSTRIES, INC.
10 Industry Drive
Lancaster, Pennsylvania
(Phone: 717-397-2777)
(Fax: 717-397-4475)

FLIGHT TERMINATION RECEIVER/DECODER

Model HFTR 110-1

RANGE SAFETY COMMAND RECEIVER

Model HFTR 100-1

HERLEY INDUSTRIES, INC.

FLIGHT TERMINATION RECEIVER/DECODER
MODEL HFTR110-1

1. GENERAL DESCRIPTION

The Herley Model HFTR110-1 Flight Termination Receiver/Decoder is a three (3) channel unit designed for missile and target applications. This unit is compact, and desirable for usage where size and weight are important considerations. The HFTR110-1 is a single-conversion receiver, with phase-locked loop tone decoders, and redundant solid-state output circuitry for high reliability, and single-point failure protection.

The HFTR110-1 is designed to the requirements of the RCC 313-89 document. The design employs the latest in devices, circuitry, and modern production processes to provide a reliable product with high quality consistency. Of particular interest is the receiver sensitivity where the HFTR110-1 is significantly better than the specification requirements.

The Herley design has significantly reduced the complexity of the receiver with far fewer parts required than previous models. The high stability of the subassembly circuitry has eliminated the need for any tuning elements in both the RF and IF sections. The HFTR110-1 includes various production processes which combine electrical and mechanical functions that result in improved performance and reduced susceptibility to shock and vibration.

This unit is intended for programs and applications with stringent environmental, EMI, and reliability requirements.

2. BACKGROUND

The unit is presently completing qualification testing to NAVAIR Specification 1588AS103.

3. TECHNICAL SPECIFICATIONS

3.1	RF SECTION	
3.1.1	Frequency Range (Tuneable)	406 to 450 MHz
3.1.2	Threshold Sensitivity (Command Output)	2 µV (-101 dBm)
3.1.3	Maximum Usable RF Input	1 Vrms (+13 dBm)
3.1.4	Operating Bandwidth	±45 KHz min
3.1.5	Antenna Impedance	50 Ω (nominal)
3.1.6	VSWR	Less than 2:1
3.1.7	Local Oscillator Stability	±0.0025%

3.1.8	Tuning Accuracy	±0.005%
3.1.9	Tuning Method	Fixed frequency, crystal controlled
3.2	IF SECTION	
3.2.1	IF Frequency	21.4 MHz
3.2.2	Selectivity, 60 dB	±375 KHz
3.2.3	Capture Ratio	Less than 0.8
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	7 KHz to 75 KHz
3.3.2	Audio Amplifier Distortion	Less than 3%
3.3.3	Audio Output	1V P-P with ±30 KHz Deviation
3.3.4	Frequency Deviation	±30 KHz per tone (nominal)
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	3
3.4.2	Number of Simultaneous Usable Tones	3
3.4.3	Tone Channel Bandwidth	±1% minimum at 2 dB
3.4.4	Adjacent Channel Rejection	Greater than 40dB
3.4.5	Decoder Threshold Deviation	14 KHz (nominal)
3.5	OUTPUT	
3.5.1	Types of Output	Solid state
3.5.2	Output Current Capability	2 Amps per output
3.5.3	Output Leakage	50 µA maximum, less than 1µA typical
3.5.4	Logic Circuitry, (List Sequence)	5 ON — Monitor 2, 5 ON — Optional &monitor 1,2 & 5 ON — Arm, optional & monitor 1 & 5 ON — Arm & monitor Then 5 OFF — Destruct & arm

3.5.5	Response Time for Commands	15 msec. nominal, 25 msec max.
3.5.6	Transition Time Between Commands	3 msec.
3.5.7	Output Isolation	All outputs and battery greater than 1 megohm from chassis
3.5.8	Noise Immunity	Greater than 12 dB
3.5.9	Telemetry Outputs	With no RF input, the quiescent is 0.5V ± 0.25V nominal increasing to a value not to exceed 4.75V ± 0.25V at an RF level of 2240μV. The slope is always positive over the RF signal dynamic range and does not exceed 5.0 volts at maximum RF input.
3.6	POWER SUPPLY	
3.6.1	Supply Voltage	22 to 36 VDC
3.6.2	Power Requirements	180 mA standby maximum, 40 mA typical. 60 mA typical commanded.
3.6.3	Power Supply Isolation	1 Megohm minimum from chassis and signal strength monitor.
3.6.4	Turn-On Power Control for Receiver	Remote
3.6.5	Other Controls	None
3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461 for antenna, power and signal leads for Air Force & Navy Category A1a Receivers, tests CE03, CE06, CE07, LS01, CS02, CS03, CS05, CS06, RE02, RS02, RS03. CS04 limits A & B are 60 db.
3.7.2	Pulse Rejection	Rejects D,E,G thru J Band radar transponder signals up to +10dBm.
3.7.3	AM Rejection	Commands will not respond up to 100% AM signals
3.7.4	Image Rejection	Greater than 60 dB

3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-54 ° C to +71 ° C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-62 ° C to + 95 ° C
3.8.3	Humidity	95%
3.8.4	Altitude	Unlimited
3.8.5	Shock	100g, 11 msec., half-sine 1100g, 0.5 msec., half-sine
3.8.6	Acceleration	30g
3.8.7	Vibration	Sine 15g peak Random 0.1g^2/Hz (12 g's rms)
3.8.8	Acoustics	Not tested
3.8.9	Pressurization	Not required
3.8.10	Operating Life	Design MTBF greater than 8,000 hours
3.8.11	Shelf Life	5 years minimum
3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	25 cubic inches
3.9.2	Dimensions	4.5 x 3.1 x 1.8 inches, less connectors. (See outline drawing)
3.9.3	Weight	25 ounces maximum
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	RF input (J1) TNC receptacle Power (J2) MS3112E-8-4P Command (J3) MS3112E-10-6S Monitor (J4) MS3112E-8-4S

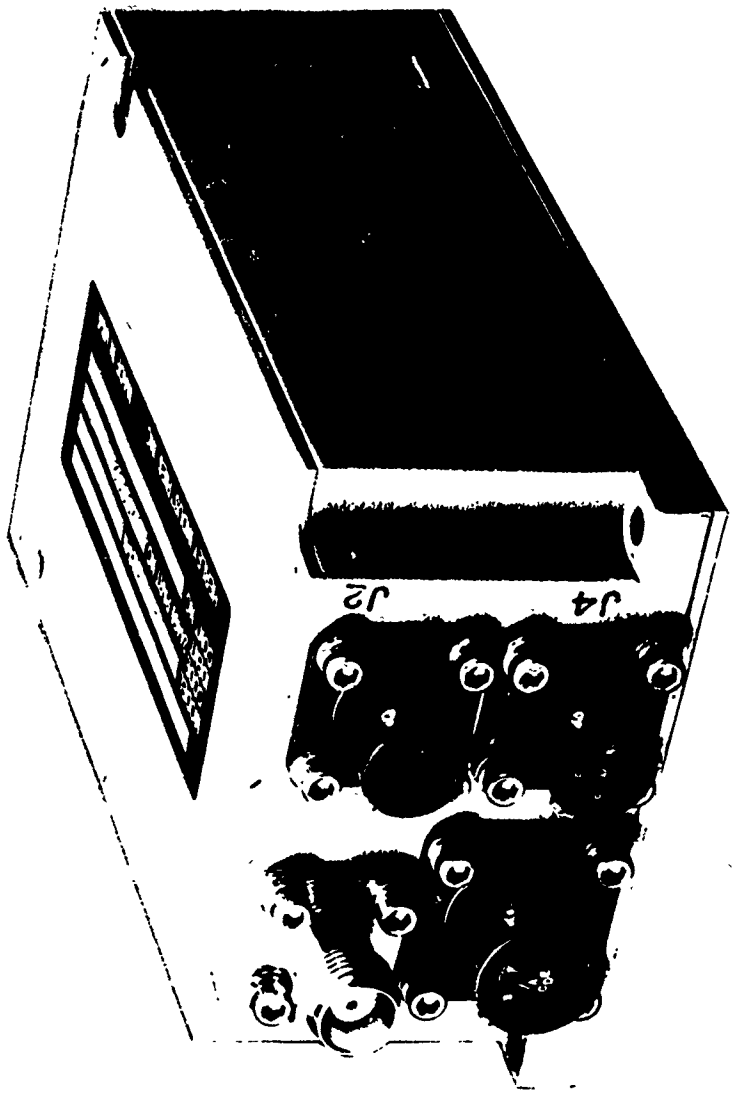


Figure 6-1. Herley Model HFTR 110-1 Flight Termination Receiver/Decoder.

HERLEY INDUSTRIES, INC.

RANGE SAFETY COMMAND RECEIVER
MODEL HFTR100-1

1. GENERAL DESCRIPTION

The Herley Model HFTR100-1 Range Safety Command Receiver is a four (4) channel unit designed for missile and target applications. The HFTR100-1 is a single-conversion receiver, with phase-locked loop tone decoders, and relay outputs to provide complete isolation from the command functions.

The HFTR100-1 is designed to the requirements of the RCC 313-89 document. The design employs the latest in devices, circuitry, and modern production processes to provide a reliable product with high quality consistency. Of particular interest is the receiver sensitivity where the HFTR100-1 is considerably better than the specification requirements.

The Herley design has significantly reduced the complexity of the receiver with far fewer parts required than previous models. The high stability of the subassembly circuitry has eliminated the need for any tuning elements in both the RF and IF sections. The HFTR100-1 includes various production processes which combine electrical and mechanical functions that result in improved performance and reduced susceptibility to shock and vibration.

This unit is intended for programs and applications with stringent environmental, EMI, and reliability requirements.

2. BACKGROUND

The unit is presently completing qualification testing to White Sands Missile Range PD No. 0009-91-B.

3. TECHNICAL SPECIFICATIONS

3.1	RF SECTION	
3.1.1	Frequency Range (Tuneable)	406 to 550 MHz
3.1.2	Threshold Sensitivity (Command Output)	0.7 μV (-110 dBm)
3.1.3	Maximum Usable RF Input	1 Vrms (+13 dBm)
3.1.4	Operating Bandwidth	Greater than ± 45 KHz
3.1.5	Antenna Impedance	50 ohms nominal
3.1.6	VSWR	Less than 2:1
3.1.7	Local Oscillator Stability	0.0025%

3.1.8	Tuning Accuracy	0.005%
3.1.9	Tuning Method	Fixed frequency, crystal controlled
3.2	IF SECTION	
3.2.1	IF Frequency	21.4 MHz
3.2.2	Selectivity, 60 dB	±300 KHz maximum
3.2.3	Capture Ratio	Less than 0.8
3.3	AUDIO SECTION	
3.3.1	Audio Amplifier Response	7.5 KHz to 32 KHz
3.3.2	Audio Amplifier Distortion	Less than 3%
3.3.3	Audio Output	0.5 V rms at ±30 KHz Deviation
3.3.4	Frequency Deviation	±30 KHz per tone nominal
3.4	DECODER SECTION	
3.4.1	Number of Decoder Channels	4
3.4.2	Number of Simultaneous Usable Tones	4
3.4.3	Tone Channel Bandwidth	Greater than ±1.0% at 2 dB
3.4.4	Adjacent Channel Rejection	Greater than 40 dB
3.4.5	Decoder Threshold Deviation	8 KHz nominal
3.5	OUTPUT	
3.5.1	Types of Output	Relay
3.5.2	Output Current Capability	2 amps per output
3.5.3	Output Leakage	None (open relay contacts)
3.5.4	Logic Circuitry, (List Sequence)	None
3.5.5	Response Time for Commands	25 msec. maximum, 15 msec. typical
3.5.6	Transition Time Between Commands	3 msec.
3.5.7	Output Isolation	Greater than 1 megohm from chassis

3.5.8	Noise Immunity	Greater than 12 dB
3.5.9	Telemetry Outputs	With no RF input, the quiescent level is 0.5V ± 0.25V increasing at a rate greater than 0.02V/dB from -110 dbm to -80dBm. The slope is always positive over the RF signal dynamic range and does not exceed 5.0 volts at maximum RF input.
3.6	POWER SUPPLY	
3.6.1	Supply Voltage	24 to 32 VDC
3.6.2	Power Requirements	Maximum 130mA uncommanded, plus 45mA per channel activated. Typical: 70mA plus 25mA per channel activated
3.6.3	Power Supply Isolation	Return connected to chassis
3.6.4	Turn-On Power Control for Receiver	Magnetic latch relay
3.6.5	Other Controls	None
3.7	ELECTROMAGNETIC INTERFERENCE	
3.7.1	RFI Suppression	Meets MIL-STD-461 for antenna, power and signal leads for Army category A1a receivers, tests CE01, CE03, CE02, RE02, RS03.2, CS04 and CS08 Limit A 60 dB, Limit B 80 dB
3.7.2	Pulse Rejection	Rejects VHF and D, G, and E Band radar transponder signals to 0 dBm.
3.7.3	AM Rejection	Rejects AM modulation to 100%
3.7.4	Image Rejection	Greater than 60 dB
3.8	ENVIRONMENTAL CHARACTERISTICS	
3.8.1	Operating Temperature Range (Continuous)	-40°C to +71°C
3.8.2	Nondestructive Temperatures (Shelf Storage)	-55°C to +85°C
3.8.3	Humidity	95%

3.8.4	Altitude	Unlimited
3.8.5	Shock	100g, 10 msec half-sine, 1150g, 1 msec half-sine 100g.
3.8.6	Acceleration	100g
3.8.7	Vibration	Sine 20g's peak, Random 0.3 g^2/Hz (20.7grms)
3.8.8	Acoustics	Not tested
3.8.9	Pressurization	Not required
3.8.10	Operating Life	MTBF calculated to be greater than 7,000 hours
3.8.11	Shelf Life	Greater than 5 years
3.9	PHYSICAL CHARACTERISTICS	
3.9.1	Volume	Less than 60 cubic inches
3.9.2	Dimensions	5.20 x 4.32 x 2.65 inches, less connectors. (see outline drawing)
3.9.3	Weight	Less than 3.5 pounds
3.9.4	Mounting Attitude	Any
3.9.5	External Adjustments	None
3.9.6	Connector Types	RF Input (J1) TNC receptacle Power (J2) MS3112E-12-10SW Command Output (J3) MS3112E-14-19S Monitor (J4) MS3112E-12-10S

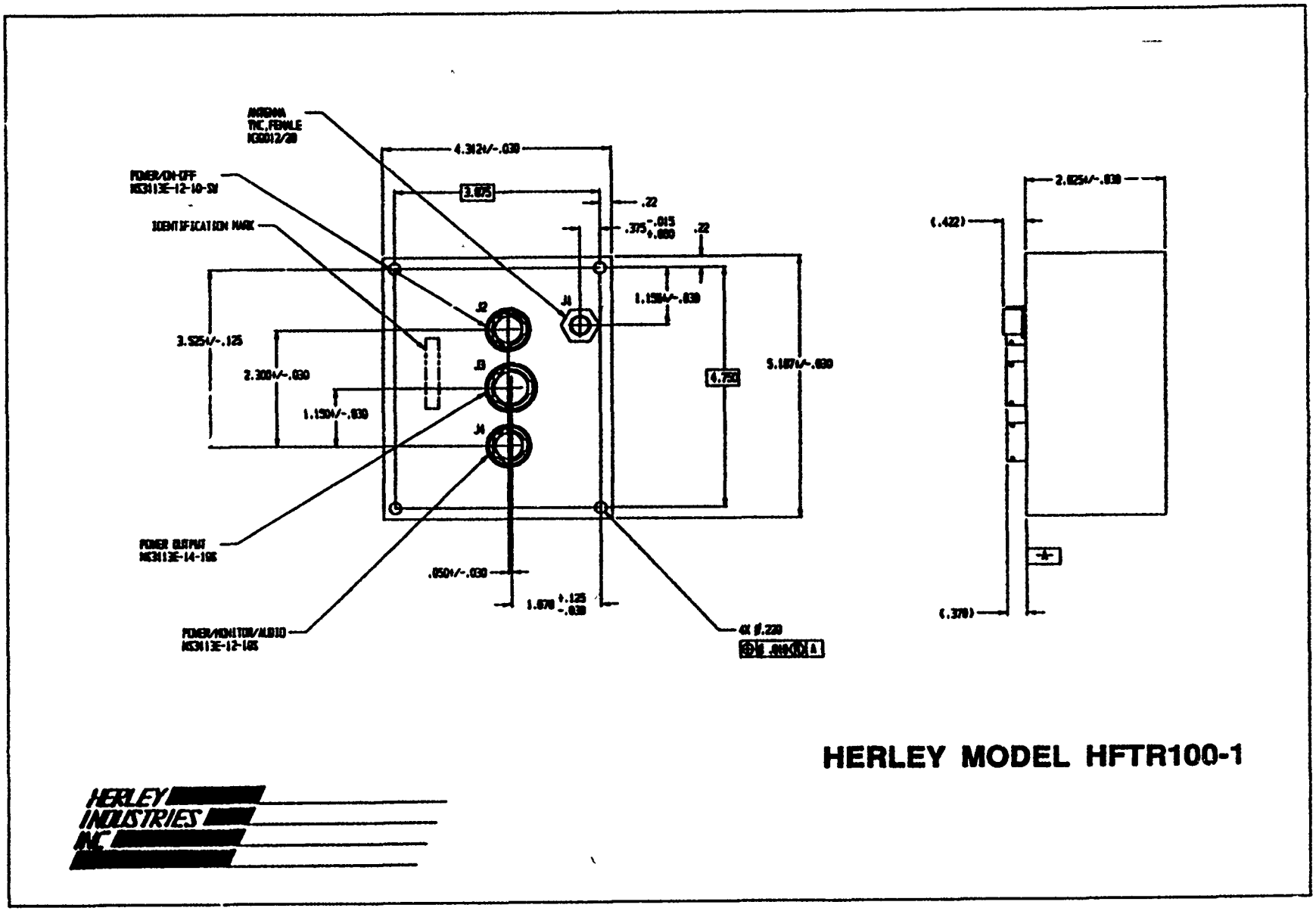


Figure 6-2. Outline drawing of Herley Model HFTR 100-1 Range Safety Command Receiver.

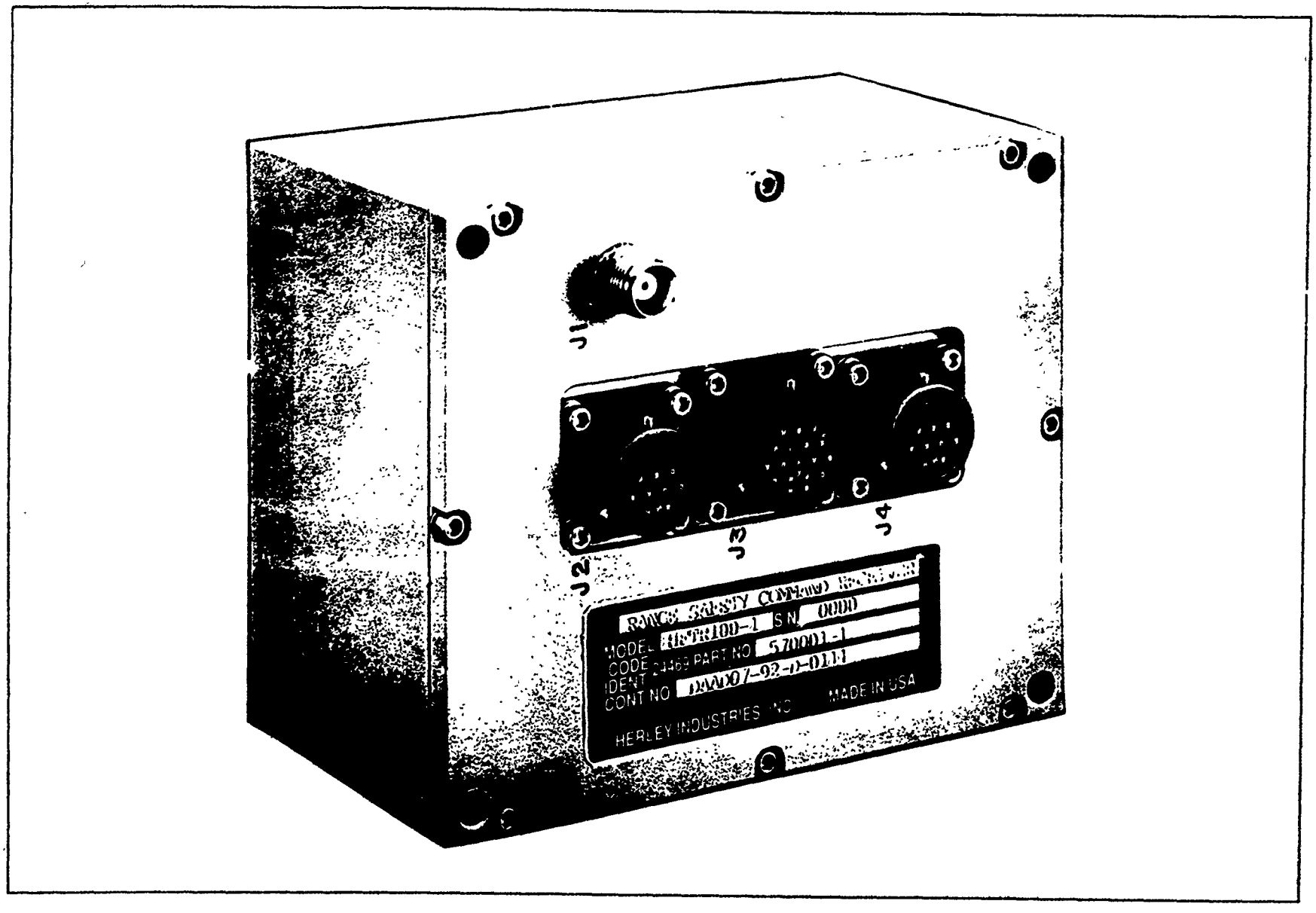


Figure 6-3. Herley Model HFTR 100-1 Range Safety Command Receiver.